NAWS

NORTHWEST AREA WATER SUPPLY PROJECT

FINAL ENVIRONMENTAL ASSESSMENT

DK-600-97-03

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PREPARED FOR
NORTH DAKOTA WATER COMMISSION
NORTH DAKOTA GARRISON DIVERSION CONSERVANCY DISTRICT
U.S. BUREAU OF RECLAMATION

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SUMMARY

This Environmental Assessment discloses and evaluates environmental impacts associated with development of the proposed Northwest Area Water Supply (NAWS) Project. The project proposes to provide drinking water of improved quantity and quality to fourteen communities and five rural water systems in northwestern North Dakota. Under the preferred alternative, pre-treated Missouri River water would be piped to Minot, where final treatment would take place, and delivered through a bulk distribution system to eleven of the fourteen communities and five rural water systems. Two communities would upgrade their existing water treatment plants by adding reverse osmosis systems, which would improve groundwater to meet secondary drinking water standards. One community would upgrade their existing water treatment plant.

Three construction alternatives and one no action alternative are evaluated and compared in this document. Federal and state resource management agencies familiar with the project area were consulted early in the planning process as well as during preparation of this assessment. Extensive impact avoidance measures were incorporated into the project's layout and design. Additional measures (environmental commitments) would be implemented during construction to further avoid, minimize, or as a last resort, mitigate project-related impacts. Tables 1 and 2 summarize the resources that comprise the affected environment and identify environmental impacts associated with project alternatives.

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Table 1. Summary of project features and costs of NAWS Alternatives

Project Feature and Costs	Alternative A - Integrated System	Alternative B - Upgrade of Existing Systems	Preferred Alternative - Combination of Alternatives A and B	No Action Alternative[1]
Pipeline system (miles)	413	6	304	0
Pumping stations	27	0	13	0
Storage reservoirs	11	0	8	0
Water treatment plants	1 pretreatment facility 1 treatment plant upgrade	17 new treatment plants 2 treatment plant upgrades 18 brine ponds	1 pretreatment facility 2 new treatment plants 2 treatment plant upgrades 2 brine ponds	none
Construction costs ($)	108,392,413	125,895,800	98,660,107	0
Annual operating costs ($)	2,310,600	3,840,900	2,288,200	0

[1]The No Action Alternative would involve no new or improved facilities to upgrade water quantity or quality under the NAWS project. Individual cities and rural water systems would continue to update and modify their water systems to meet regulations with their own or other funding sources.

Table 2. Summary of environmental impacts of NAWS Alternatives

Resource Elements	Alternative A - Integrated System		Alternative B - Upgrade of Existing Systems		Preferred Alternative - Combination of Alternatives A and B		No Action Alternative[1]	
	Temporary	Permanent	Temporary	Permanent	Temporary	Permanent	Temporary	Permanent
Prime farmland (acres)	1,707	0.9	25	0	1,600	0.7	0	0
Surface water (number)								
Perennial streams	4	0	0	0	4	0	0	0
Intermittent streams	147	0	0	0	109	0	0	0
Annual Missouri River water (demand in acre-feet)	0	10,400	0	1,090	0	9,810	0	980
Annual groundwater (demand in acre-feet)	0	0	0	9,310	0	590	0	8,580
Vegetation (acres)[2]	5,507	5.4	95	586	4,057	20.7	0	0
Cropland	3,773	3.7	65	402	2,837	13.3	0	0
Hayland	188	0.3	3	20	139	0.7	0	0
CRP	362	0.4	6	36	266	1.1	0	0
Native range	666	0.8	12	76	379	4.9	0	0
Tame range	43	0	1	6	43	0.5	0	0
Shelterbelts	170	0.2	7	45	165	0.2	0	0
Woody draws	4	0	0	0	4	0	0	0
Riverine woodlands	4	0	0	0	4	0	0	0
Wetlands (acres)	298	0	Minimal	None	220	0	None	None
Wildlife	Low risk of impact		Low risk of impact		Low risk of impact		No risk of impact	

Resource Elements	Alternative A - Integrated System		Alternative B - Upgrade of Existing Systems		Preferred Alternative - Combination of Alternatives A and B		No Action Alternative[1]	
	Temporary	Permanent	Temporary	Permanent	Temporary	Permanent	Temporary	Permanent
Fisheries	Low risk of impact		No risk of impact		Low risk of impact		No risk of impact	
Interbasin biota	Very low risk of transfer across basins		No risk of transfer across basins		Very low risk of transfer across basins		No risk of transfer across basins	
Threatened and endangered species	Little potential impact to threatened and endangered species		Little potential impact to threatened and endangered species		Little potential impact to threatened and endangered species		No risk to threatened and endangered species	
Historic Properties	Highest potential to impact historic properties		Lowest potential to impact historic properties		More potential than B but less than A to affect historic properties		No potential impact to historic properties	
Paleontological Resources	Highest potential to impact paleontological resources		Lowest potential to impact paleontological resources		More potential than B but less than A to affect paleontological resources		No potential impact to historic properties	
Social/Economic								
Population served	-	60,400	-	60,400	-	60,400	-	0
Land disturbance (acres)								
State Land Department	5.3	0	0	0	5.3	0	0	0
National wildlife refuges	77.3	0	0	0	46.7	0	0	0
U.S.F.W.S. easements	560.0	0	0	0	286.7	0	0	0
Private lands	4864.4	5.4	95	586	3,718.3	20.7	0	0

[1]There are no impacts reported due to the NAWS project under the No Action Alternative. Individual cities and rural water systems would continue to update and modify their water systems to meet regulations with their own or other funding sources, with resulting impacts.

[2] Total vegetation acres include wetland acres.

NORTHWEST AREA WATER SUPPLY PROJECT FINAL ENVIRONMENTAL ASSESSMENT

1.0 Introduction

1.1 Purpose and Scope

The purpose of the proposed Northwest Area Water Supply (NAWS) project is to provide a reliable source of high quality water to northwestern North Dakota for municipal, rural and industrial uses. This environmental assessment evaluates the potential impacts to the human and natural environment associated with three alternatives for providing this water, along with the No Action Alternative, and is intended to meet the disclosure requirements of the National Environmental Policy Act.

The NAWS project is a municipal, rural, and industrial (MR&I) water supply system designed to serve northwestern North Dakota (Figure 1). It is designed as a bulk water distribution system that will service local communities and rural water systems in ten counties. Individual water connections and the development of rural water systems are not part of the project. This environmental assessment analyzes the potential impacts to the environment resulting from project construction, which is contained in eight of the ten NAWS counties. The distribution system for the rural water systems and communities is already in place and will not be evaluated in this assessment. Any expanded use of water by a rural or an urban system that receives NAWS water will not be covered in this document; each system will be responsible for its own compliance with the National Environmental Policy Act. This assessment is intended as support documentation for the Bureau of Reclamation's decision document, which will lead to an environmental impact statement (EIS), if impacts are determined to be significant, or to a finding of no significant impact (FONSI), if impacts are determined to be insignificant.

This assessment is being prepared for the Bureau of Reclamation (Reclamation), the Garrison Diversion Conservancy District and the North Dakota State Water Commission (State Water Commission) by Houston Engineering, Inc. in association with American Engineering, P.C., Montgomery Watson, and BlueStem Incorporated. The data presented in this document are based on proposed pipeline corridors and preliminary facility locations. Some pipeline alignments and other design components of the project have not been finalized. Because this is a programmatic assessment, the information used for the assessment is based mostly on existing published and non-published data.

Published data were used extensively to identify soils, land use, wetlands, and vegetation resources. Limited field studies have been conducted to gather additional data. When final alignments and designs are determined, further review to ensure compliance with the National Environmental Policy Act and other required laws will be conducted.

This environmental assessment evaluates: A) three action alternatives and one no action alternative for the bulk water distribution system, and B) three options for intake structures at either Lake Audubon or Lake Sakakawea. It also describes and evaluates an option for pre-treating Missouri River water before it is transported to the Hudson Bay basin.

1.2 Need for Action

From a historic perspective, northwestern North Dakota has experienced water supply problems for many years. Many northwestern North Dakota municipalities and small communities, as well as farms and ranches, currently obtain their water supplies from groundwater sources which are of poor quality. Most of the cities and rural water systems considered as contract users do not currently meet secondary standards of the Federal Safe Drinking Water Act[1] (Table 3).

Groundwater supply may be sufficient, but is not readily available without developing additional wells and pipeline facilities. A few northwestern North Dakota cities have been able to take advantage of surface water supplies from the Missouri and Souris Rivers. Souris River surface water supplies are considered marginal from both a quality and quantity standpoint.

[1]The secondary standards of the Safe Drinking Water Act are guidelines that identify substances that are not hazardous to health but which may cause taste, odor, color, staining or other conditions that adversely affect the aesthetics of drinking water. Primary standards of the Safe Drinking Water Act are based on consumer health effects and are mandatory standards. Maximum contaminant levels are set at limits never to be exceeded. The major difference between the primary and secondary standards is that the secondary standards are unenforceable at the federal level. They have been issued only as guidelines for the states [Houston Engineering et al. 1988b].

Figure 1. Map of the NAWS project area.

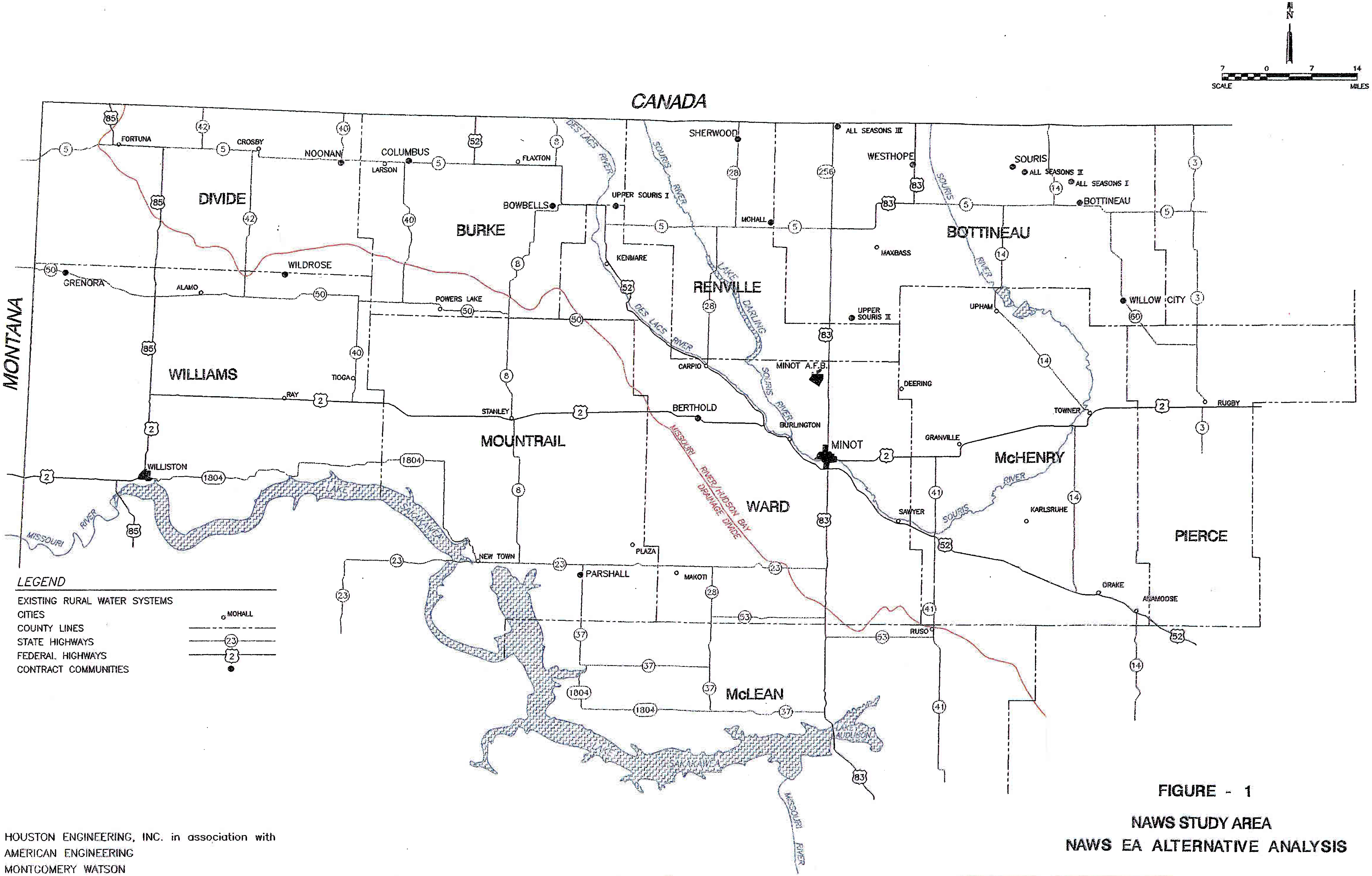

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FIGURE - 1

NAWS STUDY AREA

NAWS EA ALTERNATIVE ANALYSIS

The largest city in the project area, Minot, is currently obtaining most of its water from the Minot and Sundre Aquifers. Historically, these aquifers were both recharged from and discharged to the Souris River: when river flows were high, these aquifers were recharged by the river; when river flows were low, the river was recharged by the aquifers. This two-way relationship has changed for two reasons: A) two water storage reservoirs have been built in Canada which are reducing flows on the Souris River in the United States, and B) the increased use of water out of the Minot and Sundre Aquifers to supply Minot and surrounding areas has reduced discharge from the aquifers to the river.

The City of Minot has looked to the Missouri River as a potential water supply for several decades. When the Minot Air Force Base was constructed in the late 1950s, the Missouri River was again considered as a source of supply. Good quality water in a reliable quantity is needed throughout the project area. The NAWS project is proposed to meet these needs.

1.3 Project Authorization

The Garrison Diversion Unit's Municipal, Rural, and Industrial Water Supply (MR&I) program was authorized by the U.S. Congress on May 12, 1986 through the Garrison Diversion Unit Reformulation Act of 1986. This act authorized the appropriation of $200 million of federal funds for the planning and construction of water supply facilities throughout North Dakota.

An agreement between the State Water Commission and the Garrison Diversion Conservancy District, entitled *Agreement for the Joint Exercise of Governmental Powers*, dated July 18, 1986, provided a method through which the agencies could cooperatively work to formulate proposals for submittal to the Secretary of Interior (Bureau of Reclamation) for MR&I projects. The NAWS project, initiated in November 1987, is being developed by the State Water Commission as a result of this agreement.

The 1991 North Dakota Legislative Assembly passed a law creating a NAWS Advisory Committee and gave its full support to development of the NAWS project [NDCC 61-24.6]. The legislation also gave the State Water Commission the full authority to design, construct, and operate the NAWS project. The NAWS Advisory Committee includes representatives of municipalities, rural water associations, water resource districts, and the Three Affiliated Tribes.

1.4 Project Area

The NAWS project originally encompassed nine counties in northwestern North Dakota (Figure 1): Divide, Williams, Burke, Mountrail, Bottineau, Ward, McHenry, Renville, and the northwestern portion of McLean. The original project area also included the portion of the Fort Berthold Indian Reservation lying north of Lake Sakakawea. The project area was later expanded to include Pierce County. The bulk distribution system currently being considered

Table 3. Current water quality of NAWS communities and rural water associations.

Contract User	Water Quality Parameter					
	TDS[1] mg/L	**Sodium** mg/L	**Hardness** mg/L	**Iron** mg/L	**Sulfate** mg/L	**Manganese** mg/L
Federal 2° Standards (1994)	*500*	*20-200*	*NA*	*0.3*	*250*	*0.5*
Treated Missouri River Water	*350*	*100*	*100*	*0.08*	*200*	*0*
Berthold	2370[2]	981	17	0.062	38	ND
Bottineau	1040	51	805	0.178	394	1.89
Bowbells	1810	635	154	0.024	656.5	ND
Columbus	1830	424	599	2.73	840	0.221
Grenora	708	67	496	0.095	145	0.661
Minot/AF Base	741	246	120	0.429	280	ND
Mohall	187	16	103	ND	99	ND
Noonan	1860	789	13	ND	14	ND
Parshall	447	66	171	0.038	298	0.002
Sherwood	452	14	394	ND	93	ND
Souris	1340	307	462	2.59	522	0.345
Westhope	1290	383	308	0.363	153	0.088
Wildrose	1240	201	633	0.186	552	0.818
Willow City	860	79	616	0.315	229.7	0.812
All Seasons I	424	32	342	ND	75	ND
All Seasons II	646	116	308	0.116	234	0.003
All Seasons III	705	106	445	ND	72	ND
Upper Souris I	1400	573	51	ND	ND	ND
Upper Souris II	1230	418	223	0.289	ND	ND

[1] TDS = total dissolved solids

[2] Shading indicates the parameter does not meet secondary standards of the Safe Water Drinking Act.

ND = none detected

is contained in only eight of the ten counties in the NAWS project area, so this assessment evaluates those eight counties only. Pierce and McHenry Counties are not included. An explanation of how the project has arrived at its current configuration is contained in the following discussion.

1.5 Previous Actions and Studies

This environmental assessment is one of many documents completed on the NAWS project. Three of these, the *Final Report, Northwest Area Water Supply Study* [Houston Engineering et al. 1988b], the *NAWS/Fort Berthold Integrated Water Supply System Study* [Houston Engineering et al. 1990], and the *Final Report - Pre-Final Design* [Houston Engineering et al. 1995a] detail a large number of possible alternative water supply systems to serve the area. The three construction alternatives which represented the most plausible systems are evaluated in this environmental assessment.

The first Northwest Area Water Supply Study was initiated in November 1987 as a reconnaissance-level study and community needs assessment. During the initial needs assessment, 120 communities and 6 rural water associations were visited to obtain water quantity data, current demands, and projected future system needs. Each rural water association was contacted, and water quality and quantity data were obtained along with engineering data on their distribution systems. The information obtained from these contacts was supplemented by water quality and quantity data from the N.D. State Health Department and the State Water Commission. The *Summary Report - Needs Survey, Northwest Area Water Supply Project* [Houston Engineering et al. 1988a] provides available water quantity and quality data for each community and rural water system assessed.

The *Final Report, Northwest Area Water Supply Study* [Houston Engineering et al. 1988b], completed in November 1988, quantified the water supply needs of the original nine county area of northwestern North Dakota and outlined ten alternatives for supplying Missouri River water to the area. The recommendation of that report was to give priority to municipal and rural domestic use, with recreational and industrial uses given consideration where costs were not prohibitive.

In 1993, communities and rural water associations in the project area were presented with Agreements of Intent to Purchase Water by the State Water Commission. By signing these agreements and paying a nominal fee, communities and rural associations agreed to consider purchasing water from the project if it were ever built. In return, the State Water Commission agreed to include the city or rural system in the pre-final design phase of the project. Agreements of intent were signed by 41 communities and 9 rural water associations. Of these rural water associations, four were existing and five were proposed. The updated water needs, as well as water quality and quantity data for those communities and rural water systems which signed the agreements, were presented in the *1993 Community Needs Assessment, Northwest Area Water Supply Project, Pre-Final Design* report [Houston Engineering et al. 1993b].

The NAWS pre-final design study was initiated in 1993, with Pierce County added to the project area. The objective of this study was to advance the project to the point where final design could begin. The *Northwest Area Water Supply Project Final Report - Pre-Final Design* [Houston Engineering et al. 1995a] updated the water needs of 41 communities in the project area that expressed an interest in the project, refined alternatives for supplying Missouri River water to the area, and developed cost estimates for the project from which the cost of water to the contract user could be determined. Three separate pipeline systems were identified in the most likely configuration of the project developed in the pre-final design. These systems are explained in Appendix A.

Cost estimates developed during the pre-final design enabled the State Water Commission to prepare water service agreements for systems to be supplied by the project. In late 1994, communities participating in the pre-final design were asked to sign a water service agreement committing themselves to buying water from the project, if built. Fifteen of the 41 communities to which agreements were presented signed them. Upper Souris Water Users also signed the agreement. All Seasons Water Users has expressed interest in signing, pending a review by Rural Economic and Community Development (formerly FmHA) based on the impact signing may have on All Seasons' ability to repay construction debt owed the federal government. North Prairie Rural Water System did not sign an agreement, but its water supply is purchased from the City of Minot which did sign an agreement. The major reason cited by cities not signing the agreement was concern over the cost of the water from the project. No community or rural water association in McHenry County signed the agreement. Although Rugby in Pierce County signed the agreement, they were separated from this project because they have a high quality groundwater source available that will be developed separately and under a different schedule. Therefore, NEPA compliance for the Rugby phase is being pursued separately and is not included in this environmental assessment.

Approximately 59,200 people are served by water supply systems which have signed agreements (Tables 4 and 5). When rural water system development is included, the potential design population is about 81,000 people. For comparison, about 125,000 people live in the project area according to the 1990 census.

The project was reconfigured in 1995 to meet the needs of the communities and rural water systems which signed water service agreements; only those communities which signed the agreement were included in the reconfiguration. The West System and the Parshall System were dropped from further consideration. In the new configuration, it was anticipated that Grenora, Wildrose, Noonan, Columbus, Parshall, and Bowbells would be served either by an extension of the East System, or with individual treatment plants.

Table 4. Projected water use for communities with water service agreements.

COMMUNITY DESIGN USAGE						
Community	Population 1990 Census	Population 2010 [1] Projected	Design Use Per Capita (gallons/day)	Design Daily Use (gallons)	Peaking Factor	Design Peak Daily Use (gallons)
Berthold	409	466 409	100	40,900	2.5	102,250
Bottineau	2,598	2336 2,650	130	344,500	2.5	861,250
Bowbells	498	406 498	100	49,800	2.5	124,500
Columbus	223	151 223	100	22,300	2.5	55,750
Grenora	261	202 261	100	26,100	2.5	65,250
Minot	34,544	36567 38,000	130	4,940,000	3	14,820,000
Minot A.F.B.[2]	9,095	7599 9,095	130	1,182,350	2.5	2,955,875
Mohall	931	812 1,024	130	133,120	2.5	332,800
Noonan	231	151 231	100	23,100	2.5	57,750
Parshall	943	981 1,037	130	134,810	2.5	337,025
Sherwood	286	255 286	100	28,600	2.5	71,500
Souris	97	83 97	100	9,700	2.5	24,250
Westhope	578	533 578	130	75,140	2.5	187,850
Wildrose	193	129 193	100	19,300	2.5	48,250
Willow City	281	221 281	100	28,100	2.5	70,250

[1] Cities with a population of less than 500 inhabitants are assumed to remain static.

[2] Minot Air Force Base would be served by Minot, so is not considered a separate user.

Table 5. Projected water use for rural water systems with water service agreements.

RURAL WATER DESIGN USAGE						
Rural Water System	County Served	Number of Households	Design Use Per Household (gallons/day)	Design Daily Use (gallons)	Peaking Factor	Design Peak Daily Use (gallons)
All Seasons WUA - System I	Bottineau	242	250	60,500	2.2	133,100
All Seasons WUA - System II	Bottineau	85	250	21,250	2.2	46,750
All Seasons WUA - System III	Bottineau	305	250	76,250	2.2	167,750
North Prairie - System I[1]	Ward/McHenry	1,289[2]	250	322,250	2.2	708,950
North Prairie - System II	Ward/McHenry	268	250	67,000	2.2	147,400
Upper Souris WUA - System I	Ward/Burke/ Renville	460	250	115,000	2.2	253,000
Upper Souris WUA - System II	Ward/Renville/ Bottineau	325[3]	250	81,250	2.2	178,750

[1] North Prairie Systems I and II would be served by Minot, so are not considered a separate contract user.

[2] North Prairie - System I serves Max and Surrey as bulk users. The population for each of these communities was converted to a number of households by dividing by 2.7.

[3] Upper Souris - System II serves Glenburn and Lansford as bulk users. The population for each of these communities was converted to a number of households by dividing by 2.7.

In 1996, the State Water Commission developed three action alternatives based on the 14 communities and five rural water systems that were interested in receiving NAWS water. The *Environmental Assessment Alternative Analysis Final Report, 1997* [Houston Engineering et al. 1997a] describes the alternatives in detail. These three action alternatives, plus one no action alternative, were evaluated during this environmental assessment phase of the project. The preferred alternative would provide pre-treated Missouri River water through a pipeline from Lake Audubon or Lake Sakakawea to Minot for final treatment and distribution to all communities except Wildrose, Grenora, and Parshall. Wildrose and Grenora would have new water treatment (reverse osmosis) facilities and Parshall would have their existing water treatment facility upgraded to meet Safe Drinking Water Standards as part of the NAWS project.

1.6 Coordination with Indian Water Supply

A comprehensive MR&I system was authorized as a result of the Garrison Diversion Reformulation Act of 1986 to meet economic, public health, and environmental needs of the Three Affiliated Tribes, located within the Fort Berthold Indian Reservation. The Indian MR&I program was a part of the Garrison Diversion Reformulation Act, but was funded separately from the State of North Dakota's $200 million MR&I program.

In November 1990, a study entitled *NAWS/Fort Berthold Integrated Water Supply System* [Houston Engineering et al. 1990] was completed to integrate the Fort Berthold Reservation's MR&I project with a portion of the original NAWS project into an overall regional water supply project. The integrated study developed a plan to serve the needs of reservation communities and rural water systems north of Lake Sakakawea.

An integrated NAWS/reservation system has not materialized for various reasons. Although federal legislation proposing construction of this integrated project was drafted in 1991 and 1992, it was not introduced to Congress primarily due to concerns that it might jeopardize other funding being sought by the Three Affiliated Tribes. Another reason was the fundamental difference between the proposed reservation-wide distribution system and the previous NAWS concept of only supplying water to distribution systems such as cities and rural water associations; the actual development of rural water distribution systems had never been a part of the NAWS project. Yet another reason was the non-traditional method by which the project was formulated. Reclamation normally requires a needs assessment followed by a feasibility study before a project enters the design phase; without completion of these steps, Reclamation would not be able to support legislation for the project.

Because of these divergent concerns and the desire not to delay the NAWS project, the NAWS Advisory Committee voted in August 1992 to pursue a non-integrated project. The Three Affiliated Tribes are represented on the NAWS Advisory Committee and participated in the formulation of the NAWS project.

Reclamation has continued to work with the Three Affiliated Tribes in the development of a reservation-wide MR&I system. The Phase I construction and upgrading of reservation water systems which serve the communities of White Shield, Four Bears, and Mandaree have been completed. At its current design size, the NAWS project could not meet all of the reservation's MR&I water needs north of Lake Sakakawea to the extent that Phase II of the Fort Berthold MR&I project would meet those needs.

The City of Parshall is currently included in both the NAWS project and the Fort Berthold MR&I project. The NAWS project would meet the MR&I needs of Parshall which, according to the 1990 census, includes an Indian population of approximately 340 persons. Expansion of the

NAWS water supply at Parshall to meet rural needs in the vicinity could be developed as part of the project. Development of a rural distribution system could then occur separately. Although the City of Parshall has signed a water service agreement with NAWS and wishes to remain a part of the NAWS system at this time, development of the NAWS project in the Parshall area is not likely to occur for quite some time. Planning for Phase II of the Fort Berthold MR&I water project includes alternatives for supplying water to all communities and homes within the reservation, including the City of Parshall. Whether Parshall is supplied by NAWS or the Fort Berthold MR&I project remains to be decided; there should be adequate time to compare alternatives for serving the city from either project. This environmental assessment includes alternatives for supplying water to Parshall as part of the NAWS project.

2.0 Description of Alternatives

In the development of the various water supply systems for the NAWS project, several parameters were taken into consideration for evaluating the type of service that would be provided to the users. These parameters included quantity and quality of the water source, limits of service area, type of treatment, intake facilities, adaptability to phased construction, environmental impacts, capital costs, and operation and maintenance (O&M) costs.

The original NAWS configuration developed in 1988 included ten alternatives for delivery of Missouri River water to the NAWS project area. These alternatives were further refined in 1993 to include only three water distribution systems (East, West, and Parshall) to serve 41 communities and nine rural water associations. Brief summaries of the ten original alternatives and three refined systems are provided in Section 2.6; more detailed descriptions are provided in Appendix A. The three refined systems were further refined into three action alternatives once the 14 communities and five rural water associations signed water service agreements. The three action alternatives described herein serve these 19 contract users. The evolution of the process which resulted in these three action alternatives and one no action alternative is described in Section 1.5.

The final NAWS delivery system would consist of one of the following alternatives:

Alternative A — Integrated System
Alternative B — Upgrade of Existing Systems
Preferred Alternative — Combination of Alternatives A and B
No Action Alternative.

Selecting this array of alternatives for the environmental assessment provides a broad spectrum of the potential environmental impacts related to the construction of all or portions of the NAWS water delivery system. For purposes of this assessment, environmental impacts will only be addressed for the eight counties that are included in these alternatives. The counties of McHenry and Pierce were not evaluated.

Although sufficient groundwater supply is available in nearly every location of the NAWS area, in most cases the quality of the groundwater will not meet the Environmental Protection Agency's Secondary Drinking Water Standards for domestic use without reverse osmosis treatment. During the process of system development, all but one of the alternatives (Alternative B — Upgrade of Existing Systems) were based on the use of surface water from the Missouri River system. Because the recent construction of the Rafferty and Alameda Dams will impound a portion of the Souris River's annual flow in Canada, and given the low flows experienced on the Des Lacs and Souris Rivers during the 1988-1992 drought, the Souris and Des Lacs Rivers are considered unreliable sources to meet long-term needs of a regional water supply system.

The proposed pipeline routes for Alternative A (Integrated System) and the Preferred Alternative (Combination of Alternatives A & B) are contained in two-mile wide corridors which basically follow major roadways. Detailed and specific pipeline routes have not been selected at this time. On-site investigations would be conducted to determine exact locations, as each segment of the project goes to final design

A summary of project features, costs, and impacts of the four alternatives are provided in Tables 1 and 2.

2.1 Alternative A — Integrated System

The Integrated System provides a centralized treatment and delivery system for the delivery of pre-treated Missouri River water to contract water users. The service area for this system, shown in Figure 2, includes Burke, McLean, Mountrail, Williams, Divide, Ward, Bottineau, and Renville Counties. For illustrative purposes, Figure 2 assumes an intake located at Lake Audubon. The users would include the larger cities of Minot (which would also serve the Minot Air Force Base and North Prairie Rural Water Association), Mohall, Bottineau, and Parshall; the smaller communities of Grenora, Wildrose, Columbus, Bowbells, Noonan, Sherwood, Westhope, Souris, Willow City, and Berthold; and the Upper Souris and All Seasons Rural Water Associations.

The primary structural components of this alternative include an intake of Missouri River water at either Lake Audubon or Lake Sakakawea, a pre-treatment facility at the intake or the Max booster pump station, an upgrade of Minot's water treatment plant, pump stations, and reservoirs, and a pipeline distribution system. A description of three viable lake intake options is provided in Section 2.5.

The pre-treatment facilities would be incorporated as an integral part of the delivery system in the Missouri River Basin (see Section 2.1.1). Missouri River water would be disinfected to provide for biota transfer control through 3-log and 4-log inactivation of *Girdia* and viruses, respectively, prior to reaching the continental divide, as described in the December 1995 *NAWS Chloramine Challenge Study - Final Report* [Houston Engineering et al. 1995b]. The pre-treated water would be pumped to the upgraded Minot treatment facility for final processing before being delivered to communities and rural water systems. The Minot treatment plant would be upgraded but would not be expanded beyond its current property boundaries, so no additional land would be needed.

The pipeline distribution system would consist of approximately 413 miles of pipe ranging from 42 inches to 4 inches in diameter. The distribution pipeline would be located adjacent to existing major and secondary roads (see Figure 2). The pipeline between the intake on Lake Sakakawea/Audubon and Minot would be about 45 miles long. This 45-mile portion of the pipeline system would contain the largest diameter pipes, ranging in size from 42 inches down to 22 inches. The sizes of the pipeline segments are detailed in *NAWS Final Report, Pre-Final Design* [Houston Engineering et al. 1995a].

The NAWS pipeline system was divided into 15 segments for purposes of this environmental assessment (Table 6). Although these segments represent reaches likely to be built, segment numbering is not meant to imply the order of construction of the proposed pipeline.

Table 6. Segment numbers and descriptions for NAWS pipeline segments.

Segment Number	Description
1	Lake Audubon Intake to Minot Water Treatment Plant
2	Minot Water Treatment Plant to Maxbass Junction
3	Highway 83 to Bottineau along Highway 5
4	Highway 5 to Souris
5	Highway 5 to Westhope
6	Highway 5 to Antler
7	Highway 85 to Mohall along Highway 5
8	Highway 5 to Sherwood
9	Mohall to Bowbells along Highway 5
10	Bowbells to Noonan along Highway 5
11	Noonan to Wildrose
12	Wildrose to Grenora along Highway 50
13	Minot Water Treatment Plant to Berthold
14	Berthold to Parshall
15	Bottineau to Willow City

Construction of the 413-mile pipeline system would temporarily disturb approximately 5,507 acres. The construction right-of-way is assumed to be 110 feet wide, consisting of 50 feet of permanent right-of-way and 60 feet of temporary construction easement. All distribution lines would be placed a minimum of 7.5 feet below the surface in a trenched excavation. All pipelines with diameters greater than four inches would be installed using an open trench excavation method.

Twenty-seven pumping stations would be located along the pipeline system to maintain line pressure. There would also be 11 water storage reservoirs (see Figure 2). The total storage throughout the system would be designed to provide a volume equal to maximum daily demand for all the contract users.

2.1.1 Raw Water Pre-treatment with Final Treatment at Minot

Pre-treatment of raw Missouri River water would occur either at the intake or the Max booster pump station and consist of disinfection with either ozone or chlorine/chloramine to reduce the potential risk of interbasin biota transfer. A chloramine residual would be maintained in the pipeline for biofilm control. The pre-treatment facility would provide for biota transfer control through 3-log and 4-log inactivation of *Giardia* and viruses, respectively, prior to project water reaching the continental divide.[1] Details of the disinfection study are presented in the *NAWS Chloramine Challenge Study - Final Report* [Houston Engineering et al. 1995b]. The North Dakota Department of Health has agreed that the primary disinfection credit for the NAWS project may be achieved through the disinfection pre-treatment and that no further primary disinfection may be necessary at the Minot Water Treatment Plant beyond that necessary to maintain a disinfection residual (Appendix B).

After pre-treatment, the water would be pumped to an upgraded and expanded Minot water treatment plant for final treatment. The City of Minot will implement ultraviolet radiation (UV) treatment to provide additional disinfection safeguards. The Minot treatment plant is a conventional lime softening

[1]Additional safeguards are provided through mechanical/structural features and operational procedures, as described in the report *NAWS Project Biota Transfer Control Measures* [Houston Engineering et al. 1998] and Northwest Area Water Supply Project, Biota Transfer Control Measures Update, [Houston Engineering and Montgomery Watson, 2001]. The level of protection against biota transfer afforded by these control measures is consistent with both the findings of the Garrison Joint Technical Committee Engineering-Biology Task Group (which were subsequently accepted by the Garrison Consultative Group) and further conclusions of the Consultative Group. The NAWS project would supply drinking water that meets the Environmental Protection Agency's *National Primary Drinking Water Standards*, as identified in the most current version of the Code of Federal Regulations, Parts 141 and 142. The North Dakota Department of Health, Drinking Water Program, has primacy for implementing and enforcing the Safe Drinking Water Act in North Dakota.

Figure 2. Alternative A system configuration

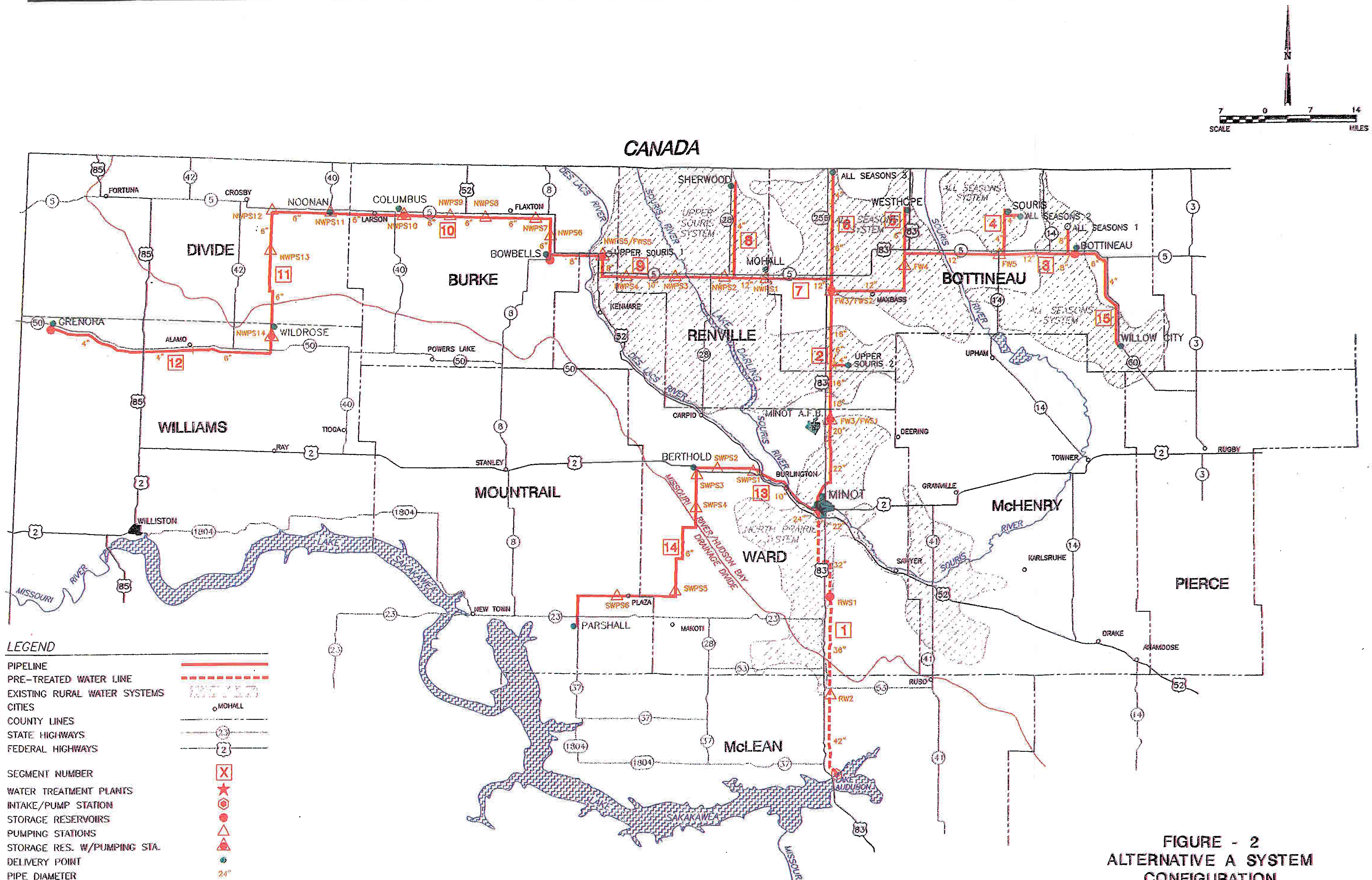

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FIGURE - 2
ALTERNATIVE A SYSTEM
CONFIGURATION
NAWS EA ALTERNATIVE ANALYSIS

treatment plant with the following existing process operations:

- Chemical feed
- Pump diffusion flash mix
- Coagulation and softening
- Re-carbonation
- Filtration
- Residual disinfection with chloramine

2.2 Alternative B — Upgrade of Existing Systems

Alternative B provides new or upgraded individual treatment systems for each of the NAWS project contract users. These contract users are:

Berthold	Minot*	Souris	All Seasons II
Bottineau	Mohall	Westhope	All Seasons III
Bowbells	Noonan	Wildrose	Upper Souris I
Columbus	Parshall	Willow City	Upper Souris II
Grenora	Sherwood	All Seasons I	

* Minot supplies water to the Minot Air Force Base and the North Prairie Rural Water Association.

The objective of Alternative B is to provide the 19 above-listed contract users with a reliable source of water having similar quantity and quality to the finished water achieved in Alternative A — Integrated System. Alternative B, however, would not use Missouri River water but would utilize each contract user's individual water source (Figure 3). Except for Parshall and Minot, each of the participating communities and rural water systems currently rely on local groundwater supplies to provide their domestic water. Generally, groundwater for these communities and rural water systems is characterized as being hard, high in total dissolved solids (TDS), and in most instances, high in either sodium, sulfate or both. Most currently utilized groundwater supplies are untreated except for disinfection by chlorination. Several rural water districts provide iron and manganese removal. Minot, Parshall, Westhope, and Mohall presently soften their water before distribution.

It would be necessary for the communities of Berthold, Bottineau, Bowbells, Noonan, Wildrose, and Willow City to drill additional wells to provide a quantity of water equal to that supplied by Alternative A — Integrated System. Approximately six miles of pipeline would be laid from new groundwater wells to treatment plants. No other pipelines would be built. This alternative would eliminate the need for 407 miles of pipeline compared to Alternative A, and 298 miles of pipeline as compared to the Preferred Alternative.

To have water of similar quality to the Integrated System and meet the secondary safe drinking water standards of the Environmental Protection Agency, each community and rural water association, with the exception of Parshall, would need a reverse osmosis treatment plant to provide high quality, treated water which would be low in TDS, sulfates, sodium, and total hardness. While the quality of the finished water from a reverse osmosis system would be very good, the reverse osmosis process requires high energy use and includes the generation of a brine which requires disposal.

Each community's reverse osmosis plant would require a building large enough to house the required number of reverse osmosis treatment units. For example, Noonan would require two units with a rating of 0.05 million gallons/day (mgd) each; Minot's plant would require ten units with a rating of 2.0 mgd each. The estimated sizes of the buildings for the reverse osmosis (membrane) facilities are as follows:

Size, Peak Flow	Number of R.O. Units	Floor Area (sq. feet)
Less than 0.37 mgd	2	1,760
Berthold, 0.52 mgd	2	2,024
All Seasons I, 0.65 mgd	3	2,530
Bottineau, 0.86 mgd	4	2,790

All contract users, except Parshall, would need to construct a new building to house the reverse osmosis units. Minot's reverse osmosis system building would be added to the city's existing water treatment plant. Parshall would not need a reverse osmosis system; the necessary treatment components could be added to existing facilities.

Disposal of the brine could be done either through deep injection wells or in an evaporation pond. Brine-evaporation ponds would have to be constructed to store the waste from any reverse osmosis plant. Brine-evaporation ponds have a design life of approximately 50 years. Each pond would have a clay or membrane liner to reduce seepage. These evaporation ponds would hold the brine solution until they were either cleaned out or sealed and reclaimed at the end of their life expectancy. The salts remaining after the evaporation of brine from the reverse osmosis process are not classified as a hazardous waste material; these salts may be disposed of in any ordinary sanitary landfill. It is assumed that brine evaporation ponds would be located near the water treatment plants of the individual communities or rural water systems. The approximate

Figure 3. Alternative B system configuration

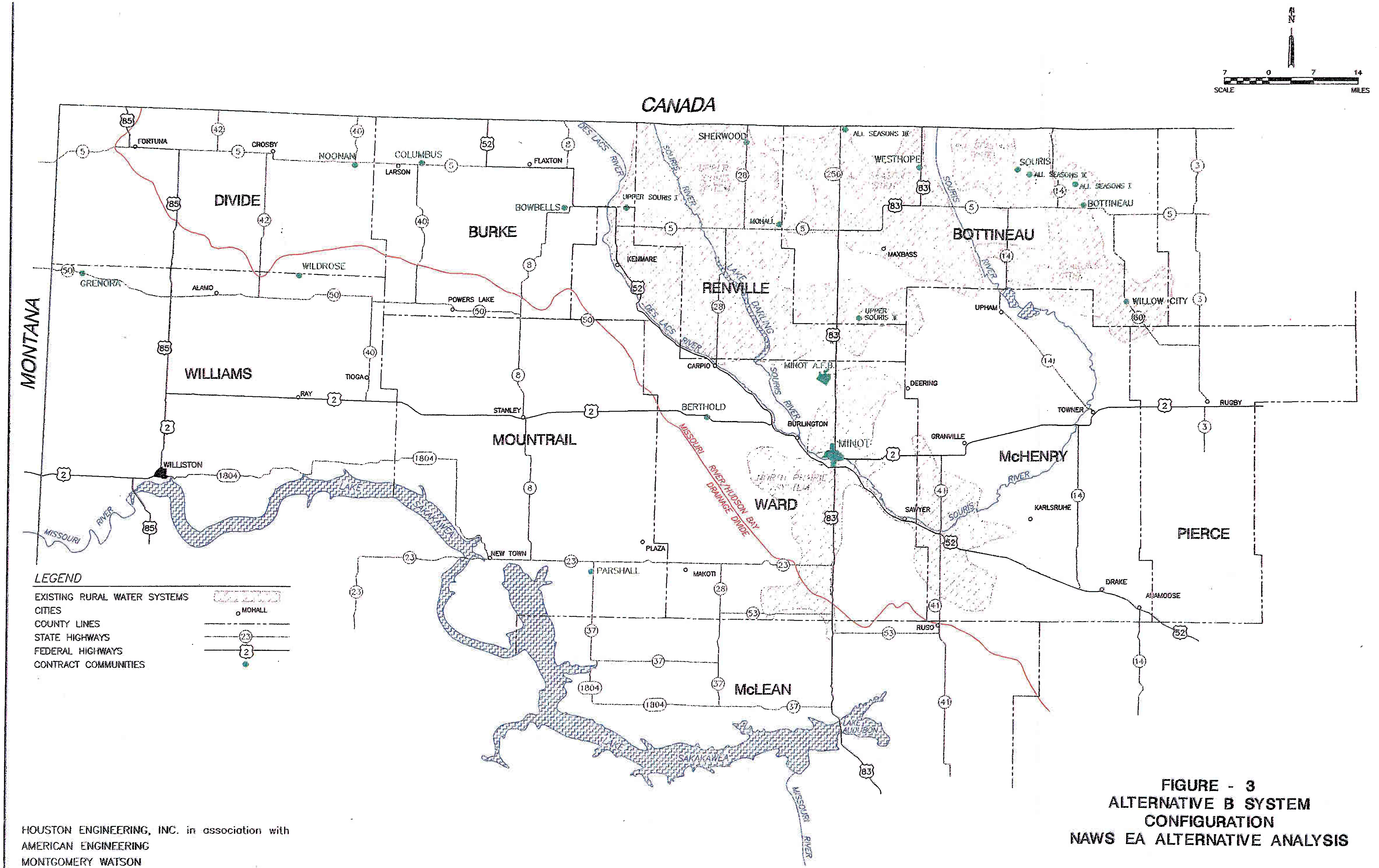

FIGURE - 3
ALTERNATIVE B SYSTEM CONFIGURATION
NAWS EA ALTERNATIVE ANALYSIS

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area in acres covered by each system's brine evaporation pond would be:

	Acres		Acres
Berthold	50.5	Souris	2.2
Bottineau	83.8	Westhope	26.2
Bowbells	27.1	Wildrose	10.5
Columbus	11.5	Willow City	10.8
Grenora	6.3	All Seasons I	71.4
Minot/Minot AFB	110.0[1]	All Seasons II	5.3
Mohall	32.4	All Seasons III	18.6
Noonan	5.6	Upper Souris I	40.8
Sherwood	46.5	Upper Souris II	26.4

Minot would treat its brine differently from the other contract users. The brine resulting from the reverse osmosis process at the upgraded Minot water treatment plant would be pumped to a temporary brine-holding pond. The brine would then be run through Minot's wastewater treatment plant where it would be processed and diluted before being discharged to the Souris River. This process would result in an increase in TDS of treated wastewater. The treated wastewater would have to meet current discharge standards before its release into the Souris River.

Disposal of brine through deep injection wells was also considered. Deep-well injection is regulated by the North Dakota Department of Health. The brine generated by reverse osmosis would result in the injection wells being classified as Class I injection wells, which require disposal below any water bearing strata. Construction costs of deep well injection systems are anticipated to be less, in some instances, than brine evaporation ponds. Annual operation and maintenance costs are several times higher for deep injection systems. Extensive studies would be required and subsurface conditions could preclude the technical viability of this option in some areas. Primarily because of the uncertainty of whether it would even be available, this option was not considered further.

Although it would not be necessary to expand the capacity of Parshall's water treatment plant under this alternative, the following modifications would be required to meet new regulatory requirements and provide a comparable level of quality and quantity to Alternative A:

- lengthening of the intake to deeper water
- addition of ozone
- addition of lagoons to handle the dewatering of sludge
- enlargement of the clear well to meet the contact time requirement

[1]The Minot/Minot AFB pond is a temporary brine-holding pond, not a brine-evaporation pond.

- addition of new controls for the modifications.

2.3 Preferred Alternative — Combination of Alternatives A and B

The Preferred Alternative is a combination of Alternative A — Integrated System and Alternative B — Upgrade of Existing Systems. Development of the Preferred Alternative was based on the capital costs for both an integrated system and individual treatment systems.

Comparisons of the capital costs of Alternatives A and B indicate that Alternative A — Integrated System is less expensive for most contract users than Alternative B — Upgrade of Existing Systems. Those communities where individual treatment systems would cost less than an integrated pipeline system are Parshall, Grenora and Wildrose. Figure 4 shows the configuration of the Preferred Alternative — Combination of Alternatives A and B; it has a central distribution and treatment system serving all the contract users except Parshall, Grenora, and Wildrose.

The Preferred Alternative would have one intake at either Lake Sakakawea or Lake Audubon, a pre-treatment facility at the intake or the Max booster pump station, one central treatment plant at Minot, eight storage reservoirs, 13 pumping plants, 304 miles of distribution pipelines, two new treatment plants with drain ponds (Wildrose and Grenora), and one upgraded treatment plant (Parshall). A description of pre-treatment of Missouri River water at Lake Sakakawea or Lake Audubon is described in Section 2.1.1. The treatment plants for Parshall, Wildrose, and Grenora would be the same in this alternative as previously described in Alternative B.

2.4 No Action Alternative

The No Action Alternative would require the ten-county regional area to rely on existing water supplies as well as treatment facilities. Individual projects within the NAWS project area would continue to be funded on an individual basis through the State of North Dakota MR&I program. Site specific NEPA documents would be required for individual projects formulated outside the scope of the NAWS project which use federal dollars.

Figure 4. Preferred alternative system configuration

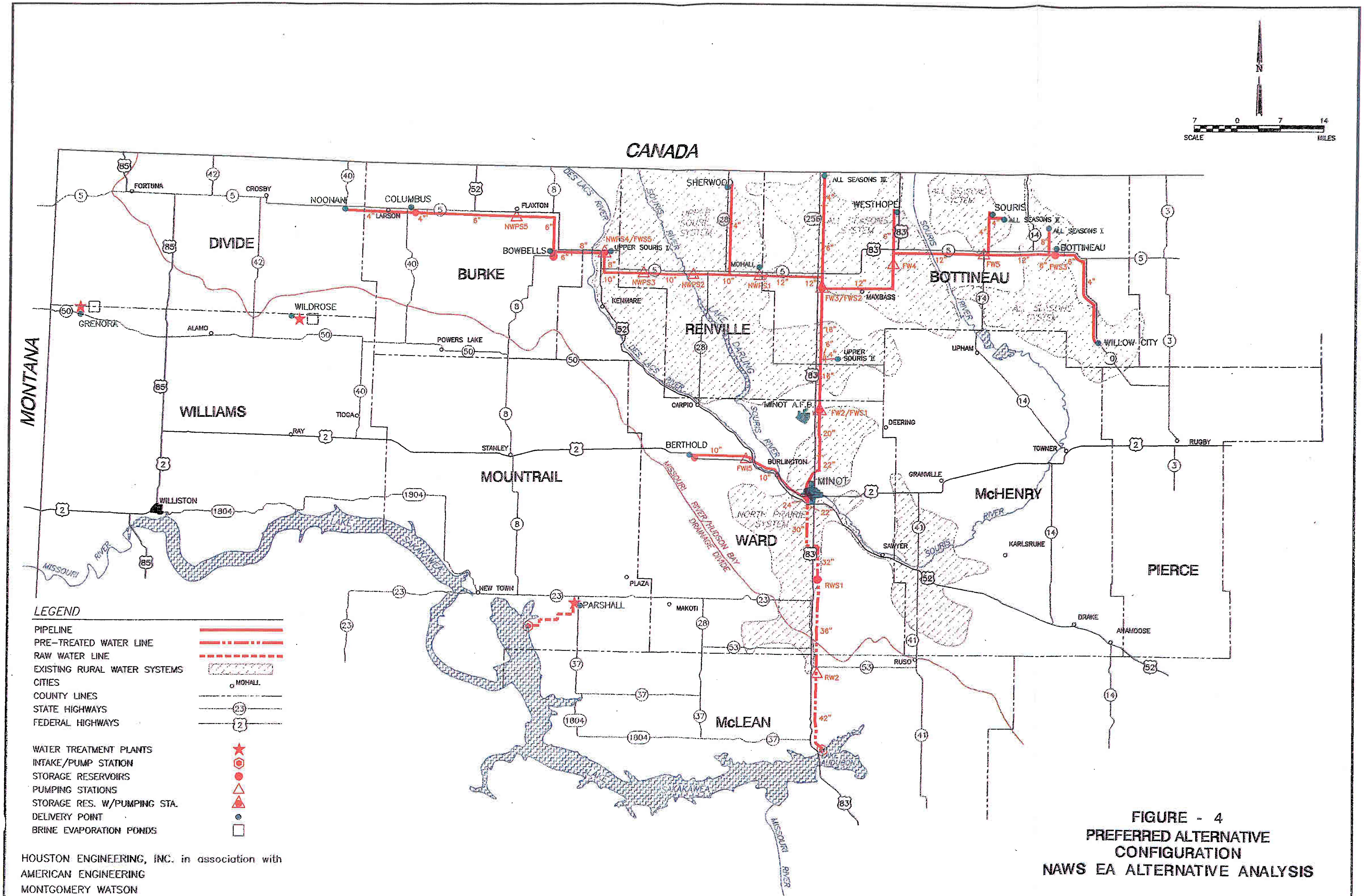


FIGURE - 4
PREFERRED ALTERNATIVE
CONFIGURATION
NAWS EA ALTERNATIVE ANALYSIS

2.5 Intake Options for Lakes Sakakawea and Audubon

Both Alternative A — Integrated System and the Preferred Alternative — Combination of Alternatives A and B would draw Missouri River water from either Lake Sakakawea or Lake Audubon through an intake facility. Twelve intake options were evaluated during the pre-final design phase of the project. Summaries of the considered intake options are contained in *NAWS - Intake Alternatives for Lakes Sakakawea and Audubon* [Houston Engineering et al. 1997b]. Figure 5 shows the locations of all proposed intake options. Work continues on the refining of the intake options.

Intake option site locations were grouped as follows:

1) Modification to the existing Snake Creek Pumping Plant
2) Lake Sakakawea intakes
3) Lake Audubon intakes.

The four intake options which proposed major modifications in the operation of one of the three Snake Creek Pumping Plant units (Options 3, 4, 5, and 6) were rejected because they were not compatible with the designed operation of the pumping plant. Three of the four Lake Sakakawea intake options (Options 1, 2, and 9) were rejected because of structural and hydraulic problems or high construction costs. Two of the four Lake Audubon intake options (Options 7a and 10) were rejected because of potentially poor water quality and high construction cost. Evaluation continues on Options 7, 8 and 11, the three intake options still under consideration.

2.5.1 Intake Option 7 - Lake Audubon - Shallow Water Intake on Embankment

This option would involve construction of a stand-alone intake/pump station on the east side of the Snake Creek Embankment approximately 120 feet north of the existing Snake Creek Pumping Plant discharge structure. The NAWS facilities would include a concrete intake structure situated on the bank, a screening facility, a wet-well pump station, instrumentation and controls, modifications to the existing discharge structure access road, and embankment enlargement to site the structure. The shallow water intake would be 20 feet or less below the surface. A channel, at elevation 1,830 feet mean sea level (msl), would also need to be constructed from the proposed intake to the existing discharge channel of the Snake Creek facilities. The estimated project cost of this option is $3.0 million. The annual operation and maintenance cost is estimated at $143,750 per year. Option 7 is described in greater detail in Section 5 of the *Final Report - Pre-Final Design* [Houston Engineering et al. 1995a].

2.5.2 Intake Option 8 - Lake Sakakawea - Intake on Northwest Corner of Snake Creek Pumping Plant

This intake site is located on the northwest corner of the Snake Creek Pumping Plant forebay. The intake would consist of a 25-foot diameter caisson descending 100 feet to 1,770 feet msl, with a 700-foot long tunnel into the inlet channel to the Snake Creek Pumping Plant. The intake would lie from five feet below the surface when Lake Sakakawea is at its minimum pool elevation of 1775 feet msl to 84 feet when Lake Sakakawea is at its maximum pool elevation of 1854 feet msl. The inlet tunnel would be equipped with static screens capable of multi-level draw off in the reservoir. The facilities would also include a wet-well pump station, instrumentation, and controls. The estimated project cost of this option is $5.9 million, and the annual operation and maintenance cost is estimated at $163,450.

2.5.3 Intake Option 11- Lake Audubon - Deep Water Intake at Site of Option 7

This intake option is located at the same site as Option 7 (Lake Audubon - shallow water intake), but utilizes a 1500-foot long intake pipeline to access deep water. The intake pipeline would be laid along the lake bottom to elevation 1,790 feet msl. The intake would lie approximately 55 feet below the surface when Lake Audubon is at its operating elevation of 1845 to 1847 feet msl. The estimated project cost of Option 11 is $3.4 million. The annual operation and maintenance cost is estimated to be the same as Option 7, at $143,750 per year.

Options 8 and 11 are both considered to be deep water intakes; Option 7 is a shallow water intake. The deep water intake options would have fewer impacts on fisheries (see Section 3.5) and would have more stable water quality characteristics with fewer impacts to disinfection effectiveness. The major advantage of the shallow water intake is lower cost. Estimated intake facility costs presented here do not include pre-treatment costs.

Figure 5. Intake option locations

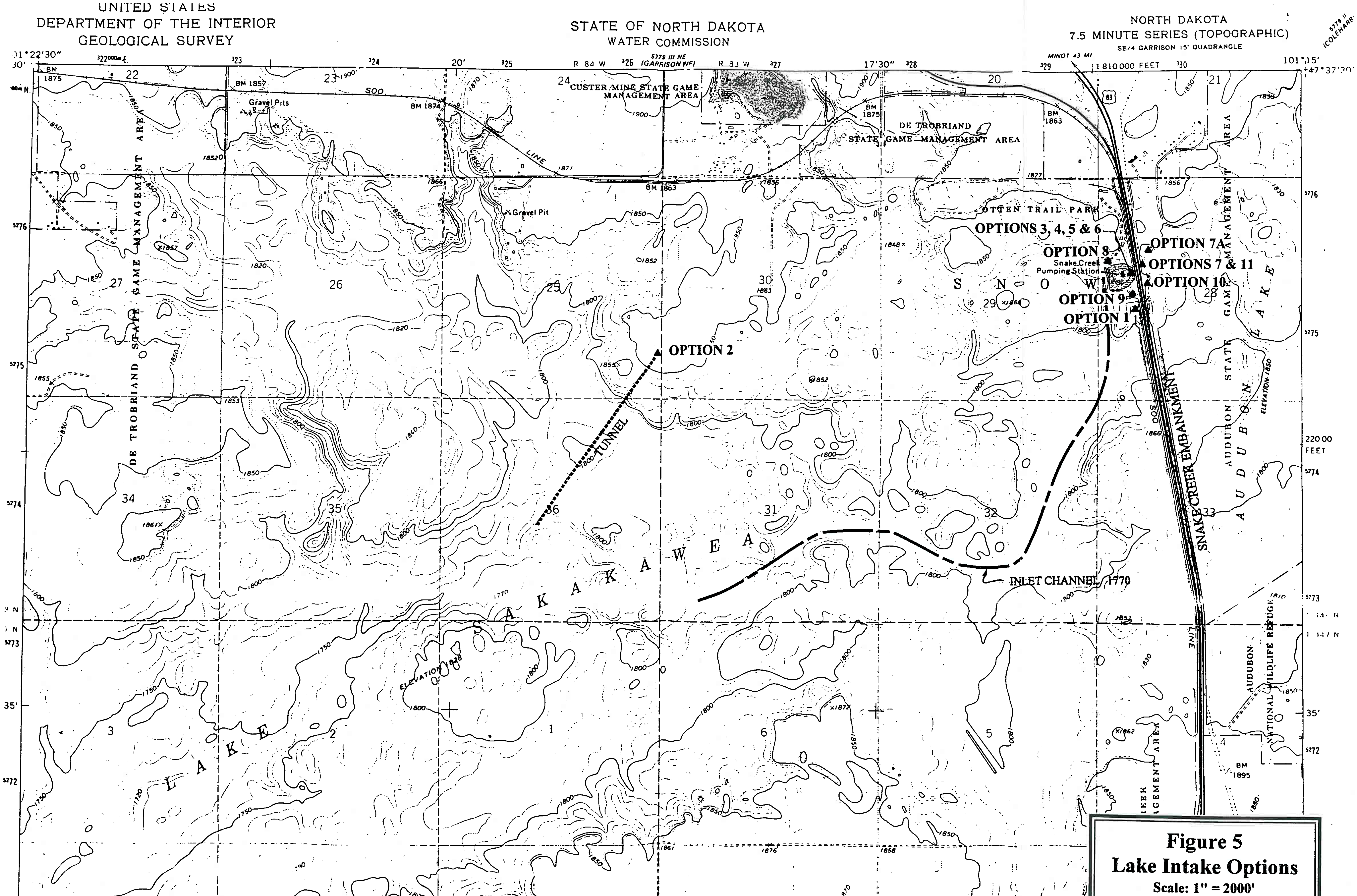


Figure 5
Lake Intake Options
Scale: 1" = 2000'

2.6 Alternatives Considered but Eliminated

The 1988 NAWS study [Houston Engineering et al. 1988b] examined ten water supply system alternatives to serve the NAWS project area. See Appendix A. These included:

Alternative 1 — East Water Supply System, Base Plan
Alternative 2 — East Water Supply System, Alt. N° 1
Alternative 3 — East Water Supply System, Alt. N° 2
Alternative 4 — East Water Supply System, Alt. N° 3
Alternative 5 — West Water Supply System, Base Plan
Alternative 6 — West Water Supply System, Alt. N° 1
Alternative 7 — West Water Supply System, Alt. N° 2
Alternative 8 — Parshall System
Alternative 9 — New Town/Stanley System
Alternative 10 — Ray/Tioga/Stanley System

The above ten alternatives were eliminated in 1993; changes and combinations resulted in three system alternatives [Houston Engineering et al. 1995a]:

East System
West System
Parshall System.

Among the reasons for the changes were:

- Some of the originally proposed communities or rural water systems received water from another source and were not interested in receiving water through the NAWS project.
- Some communities and rural water systems were no longer interested because of anticipated costs.
- As communities and rural water systems dropped out, the alternatives were reconfigured to meet the needs of users who remained interested in the project.

Brief summaries of the eliminated alternatives follow. Appendix A provides more detailed information. Readers who are interested in specific details should refer to the *Final Report, Northwest Area Water Supply Study* [Houston Engineering et al. 1988b] and the *Northwest Area Water Supply, Final Report - Pre-Final Design* [Houston Engineering et al. 1995a].

Eliminated Alternative 1 — East Water Supply System, Base Plan

This alternative would have included distribution of Missouri River water to northern McLean, Ward, McHenry, Renville, and Bottineau Counties. The design population was 88,627. The intake structure would have been at Lake Audubon and would have included a conventional water treatment plant at Lake Audubon so treated water would have been distributed to all users. This alternative would have included approximately 415 miles of pipeline.

Eliminated Alternative 2 — East Water Supply System, Alt. N° 1

The distribution system and design population for this system would have been the same as Eliminated Alternative 1. The intake structure at Lake Audubon would have included ozonation treatment and microstraining for biota control. The Minot treatment plant would have been used to provide final treatment prior to distribution to the southeast, east, west, and north. For the communities of Garrison and White Shield, raw water would have been extracted from Lake Sakakawea and treated in a treatment plant in Garrison. This alternative would have had approximately 420 miles of pipeline. Since 1988, Garrison has constructed a Lake Sakakawea intake and treatment plant. White Shield has developed an intake on Lake Sakakawea and a treatment plant.

Eliminated Alternative 3 — East Water Supply System, Alt. N° 2

The distribution system for this alternative would have been the same as Eliminated Alternative 1 with the addition of Mountrail County. The design population was 96,787. Parshall would not have been included in the system. The intake structure and treatment plant would have been at Lake Audubon, the same as Eliminated Alternative 1, but slightly larger in size to handle the additional area serviced. Garrison would also have had its own intake and treatment plant. This alternative would have had approximately 510 miles of pipeline.

Eliminated Alternative 4 — East Water Supply System, Alt. N° 3

The distribution system for this system would have been the same as Eliminated Alternative 3 with the addition of Divide, Burke, and Williams Counties. The design population was 106,537. The intake and treatment facilities would have been expanded to serve the additional users. This alternative would have had approximately 700 miles of pipeline.

Eliminated Alternative 5 — West Water Supply System

The distribution area for this alternative would have included Williams, Divide, and Burke Counties and served a design population of 34,160. This system would have used the City of Williston's existing intake from the Missouri River and its water treatment plant. The plant would have been expanded to double its capacity. Treated water would have been distributed throughout the system, requiring no additional treatment plants. This alternative would have had approximately 230 miles of pipeline.

Eliminated Alternative 6 — West Water Supply System, Alt. N° 1

This alternative would have serviced the same area as Eliminated Alternative 5, but would have used Missouri River water for Williston and the Williams Rural Water System only. The remaining users would have utilized the Grenora Aquifer; a well and treatment plant would have been developed in the Grenora area. The design population was 28,385. The treatment plant would have used reverse osmosis to reduce sulfate, sodium, and TDS. This alternative would have had approximately 175 miles of pipeline. It was determined, however, that the Grenora Aquifer would not be able to provide a reliable long-term source of water for these northwestern communities because of the significant drawdown it experienced during the 1988 to 1992 drought years.

Eliminated Alternative 7 — West Water Supply System, Alt. N° 2

This alternative would have serviced the same area as Eliminated Alternative 6 with the addition of water from the Grenora Aquifer to the existing Ray and Tioga Water Systems. The design population was 32,768. The well field and treatment capacity would have been increased to accommodate that system. This alternative would have had approximately 195 miles of pipeline. This alternative was eliminated because of the unreliability of the Grenora Aquifer.

Eliminated Alternative 8 — Parshall System

The service area for this alternative would have included southeast Mountrail County and southwest Ward County. The design population was 4,198. The City of Parshall's existing intake and water treatment plant would have been utilized to draw Missouri River water from Lake Sakakawea. This alternative would have had approximately 30 miles of pipeline. As the NAWS project evolved, the city of New Town was added to this alternative.

Eliminated Alternative 9 — New Town/Stanley System

This distribution system would have served the cities of New Town, Stanley, and Ross. The design population was 5,128. An intake on Lake Sakakawea would have been built west of New Town near the Four Bears Memorial Bridge, as well as a treatment plant near New Town. This alternative would have had approximately 40 miles of pipeline. The City of Stanley was connected to the Ray/Tioga system, which provided a good water supply, so there was no longer a need for this alternative.

Eliminated Alternative 10 — Ray/Tioga/Stanley System

This alternative would have served the cities of Ray, Tioga, Ross, and Stanley through development of the Ray Aquifer. The design population was 7,475. Additional wells would have been developed and the existing Ray treatment facility would have been expanded. This alternative would have required an additional 34 miles of 10-inch pipeline. A pipeline from Ray to Tioga was completed in 1995 to serve Stanley, using the existing water treatment system, so this alternative is no longer needed.

Pierce County was added to the NAWS area in 1995, and the State Water Commission together with the consulting engineers further refined the previous ten eliminated alternatives into three integrated distribution systems: the West System, the Parshall System, and the East System. Summaries of these integrated systems follow.

West System

The West System would have served Williams, Divide, and Burke Counties and a portion of Mountrail County. The design population was approximately 27,000 people. The system would have used the City of Williston's intake structure on the Missouri River and its existing water treatment plant, which would have been upgraded to handle the additional capacity. This system would have required approximately 220 miles of pipeline.

Parshall System

The Parshall System would have used the existing Missouri River water intake on Lake Sakakawea near Parshall. The Parshall water treatment plant would have been upgraded to provide additional capacity for New Town, Makoti, Plaza, and the proposed Mountrail Rural Water System. The design population was about 4,700 people. This system would have required approximately 38 miles of new pipeline.

East System

The East System would have served the northern portion of McLean County; all of Pierce, McHenry, Renville, and Bottineau Counties; and the eastern two-thirds of Ward County. The design population was 80,300 people. A new intake structure would have been built at Lake Audubon, and the Minot treatment plant would have been upgraded to supply the remainder of the East System. The system would have required approximately 460 miles of new pipeline.

With input from the NAWS Advisory Committee, the State Water Commission, and the contract water users, these three distribution systems were consolidated to finally arrive at the three alternatives presented previously in Sections 2.1, 2.2, and 2.3 of this environmental assessment.

2.7 Treatment Options for Missouri River Water Considered but Eliminated

Two options were analyzed and eliminated for the treatment of Missouri River water to reduce the possibility of interbasin biota transfer into the Hudson Bay watershed. Both Alternative A — Integrated System and the Preferred Alternative — Combination of Alternatives A and B would use Missouri River water. Section 2.1.1 describes the selected treatment process.

2.7.1 Full Treatment at Minot

This option would have pumped untreated Missouri River water directly from Lake Sakakawea or Lake Audubon to an expanded and upgraded Minot water treatment plant for treatment. The cost of treatment at the Minot water treatment plant was developed in the Northwest Area Water Supply Project, Final Report - Pre-Final Design [Houston Engineering et al. 1995a]. The estimated construction cost of $12.2 million was increased by 30 percent to account for contingencies, engineering, and administration. The resulting project cost for upgrading the Minot water treatment plant would be $15.9 million.

The water would not have been treated in any manner before being pumped to Minot. Various engineering designs were developed to ensure pipeline integrity and confine any spills which might have occurred along the pipeline within the Hudson Bay watershed. This option was thoroughly discussed at numerous sessions of the Garrison Joint Technical Committee. After consideration by the NAWS Advisory Committee and the State Water Commission, this option was dropped because of unacceptable risk of interbasin biota transfer. Engineering solutions could not be developed which would reduce the risk to an acceptable level and keep costs within reasonable limits.

2.7.2 Full Treatment at Lake Sakakawea or Lake Audubon

This option would have entailed the treatment of Missouri River water by conventional water treatment plant near the intake site on Lake Audubon or Lake Sakakawea. It would have required the construction of a complete, new treatment plant. The plant would have included the following systems:

- Raw Missouri River water intake
- Chemical feed
- Pump diffusion flash mix
- Coagulation and softening
- Re-carbonation
- Filtration
- Ozone or chlorine/chloramine disinfection
- Residual disinfection with chlorine and ammonia to form chloramine

Previous studies have evaluated the potential for treatment of the NAWS water supply at either Lake Audubon or Lake Sakakawea. Cost estimates for a water treatment plant at the raw water intake location were revised in March 1994 for use by, and consultation with, the NAWS Engineering - Biology Task Group in the preparation of their report dated May 1994. The construction cost for a water treatment plant at the intake location was identified at $21.7 million. The total project cost (including 30 percent for contingencies, engineering, and administration) would be $28.2 million.

The difference in cost between a full treatment plant at Lakes Audubon or Sakakawea and upgrade of the Minot treatment plant (see Section 2.7.1) is $12.3 million ($28.2 million - $15.9 million). If the project cost for the intake chloramination facility is included for the Minot water treatment plant alternative, the difference in costs between the alternatives is reduced to $12 million.

The NAWS project would be constructed in phases, with the first phase being the water supply pipeline to Minot. Construction of the first phase would occur over a five year period (at an estimated project cost of approximately $45 million). Thirty-five percent of the cost of this pipeline would be funded by water fees. The most difficult part of financing any revenue generating project is funding that portion which is to be built before the project can generate revenue. When water fees are to be used to pay for the project, the project cannot begin to generate revenue until water can be sold.

Under Alternative A and the Preferred Alternative, expansion of the Minot water treatment plant would be deferred until after water from the pipeline reaches Minot. As stated earlier, the estimated cost of the expansion and upgrade of the Minot water treatment plant is approximately $15.9 million. With full treatment within the Missouri River basin, not only would the pipeline have to be built before water could be sold, but a treatment plant would also have to be constructed, thereby increasing the up-front cost by $28 million, which is an increase of approximately 60 percent. The entire cost of the treatment plant would have to be financed as part of the first phase, which would place a significant financial burden on the users of project water and would therefore be cost prohibitive.

Minot has expressed the desire to maintain operation of its water treatment plant for economic expansion possibilities. In its current configuration, the Minot water treatment plant would be able to treat Missouri River water with few modifications (estimated at $3 to $4 million in construction costs) to accommodate the water demands under Phase 1. Construction of a new water treatment plant at the intake would initially result in the closure of the Minot water treatment plant (loss of existing invested capital). The construction of a treatment plant at the intake location would also involve additional issues with providing operation and maintenance of the facilities. The treatment plant at the intake would be in remote location which would result in significant problems for O&M crews with regard to travel time to the location and ability to respond to O&M problems on short notice. Construction of a new treatment plant at the intake site would be redundant with the capabilities that exist or will be added to the Minot plant. Other less expensive alternatives to achieve biota control are considered in more detail in later in this document. The use of Minot's water treatment plant for final treatment was considered the most viable and most supportable treatment alternative in terms of costs, financing, and use of existing facilities.

3.0 Affected Environment and Environmental Consequences

The environmental consequences of the four described alternatives are presented in this section.

In general terms, the pipeline distribution system would consist of approximately 413 miles of new pipeline for Alternative A, 6 miles for Alternative B and 304 miles for the Preferred Alternative. The No Action Alternative would require no new pipelines as part of this project. Pipeline routes for the alternatives have been preliminarily located within a two-mile wide corridor. Pipeline diameter would range from 42 inches for the main line from Lake Audubon/Sakakawea to Minot down to four inches at Grenora. All pipe greater than four inches would be placed by open trench excavation.

For purposes of assessing impacts to most resources, a 110-foot construction right-of-way was assumed for pipeline construction, consisting of 50 feet of permanent right-of-way and 60 feet of temporary construction easement. Impacts to trees were calculated using a 50-foot construction right-of-way; it was assumed that construction specifications would, as much as possible, require minimal impacts to woodlands and shelterbelts. To estimate impacts to historic properties, a file search was conducted for the entire two-mile wide corridor. A 100-foot construction right-of-way was used for the six miles of new pipeline needed in Alternative B to connect new wells to treatment plants, since these would be smaller lines.

The following resource categories were used to describe potential impacts: geology, topography and soils, water resources, vegetation, wildlife, fisheries, interbasin biota, threatened and endangered species, wetlands, historic properties, paleontological resources, aesthetics, land use and ownership, Indian trust assets, and social/economic resources. The beginning of each resource section describes the existing environmental conditions in eight counties in the NAWS project area. Following the resource description, potential effects of each alternative are disclosed.

Additional National Environmental Policy Act documentation may be required upon completion of the final design. An Impact Mitigation Assessment team would be formed by the Bureau of Reclamation's Dakotas Area Office to evaluate actual project impacts and to monitor compliance with project commitments designed to avoid or mitigate adverse effects (see Section 8.1 - Environmental Commitments). The Impact Mitigation Assessment team would be composed of environmental specialists from Reclamation, the State Water Commission and other project sponsors, consulting engineers, U.S. Fish and Wildlife Service, and the North Dakota Game and Fish Department. When construction takes place on lands administered by other agencies or on private lands, specialists of the agencies or landowners would be invited to become members of the team for that part of the construction affecting them.

Each year, before annual construction began, the Impact Mitigation Assessment team would review work plans to ensure commitments are understood and are being followed. After each construction season, or more frequently if deemed necessary, a review of "as built" facilities would be conducted by the Impact Mitigation Assessment team to determine if adverse impacts have occurred which require mitigation. Project impacts, mitigation, and other recommendations of the Impact Mitigation Assessment team would also be entered into Reclamation's Garrison Diversion Unit ledger for resolution prior to project completion. Mitigation, if required, would be on an acre-for-acre basis, based on ecological equivalency, and would be completed concurrently with project construction. Any changes in the construction program warranting additional National Environmental Policy Act or National Historic Preservation Act compliance would be addressed by the Impact Mitigation Assessment team.

3.1 Geology, Topography, and Soils

3.1.1 Affected Environment

The topography of northwestern North Dakota is a result of Pleistocene glaciation. When the glaciers overrode the land, they planed off the rugged features and filled valleys and depressions with debris that had been carried southward by the ice. Sediments associated with glaciation were deposited as outflows from the ice or as streams flowing from within the melting glaciers which deposited sand and gravel seams as the glaciers retreated. Layers of sand, silt, and clay were deposited in glacial lakes. All of these materials deposited by the glacier, whether by stream, lake, or wind are collectively known as glacial drift.

Two major glacial landforms are found in northwestern North Dakota: the Missouri Coteau and the Glaciated Plains (or Drift Prairie). The most rugged kind of topography of glacial origin, a hummocky collapsed glacial topography, is found extensively on the Missouri Coteau and is often referred to as dead-ice moraine. This type of terrain is characterized by hilly areas and thousands of lakes and sloughs. Many of these depressions resulted from blocks of glacial ice trapped in sediments as the glaciers receded. This topography gives rise to what is called the prairie potholes.

The landscape of the Glaciated Plains has low to moderate relief; the term "undulating collapsed topography" is often used to describe this type of landscape. Moderate amounts of glacial till were deposited by the glaciers, both while moving and while melting. These areas generally are much flatter and contain less glacial debris than the Missouri Coteau. The Glaciated Plain includes the Souris Lake Plain with its fairly level topography and rich soils, features characteristic of a glacial lake plain [Bluemle 1991].

The topography of the NAWS project area consists of a wide variety of landforms and topographic conditions. The southern edge of the project area is bounded by the Missouri River valley and Lake Sakakawea, a man-made reservoir on the Missouri River. The average elevation on the lake is approximately 1,840 feet msl, but varies widely with annual runoff conditions and operation of the Missouri River reservoir system. Moving northward from the Missouri River valley, through the Missouri Coteau region, the land rises sharply. The Coteau landform runs diagonally across the project area forming the drainage divide between the Missouri River and the Hudson Bay watersheds. This drainage divide is poorly defined in some areas because of large enclosed watersheds and rough hummocky topography, which is interspersed with hills and sloughs with poorly defined water courses.

The soils in the eight-county area have been classified by the Natural Resources Conservation Service as predominately Group B soils. Group B soils are those with moderate infiltration rates and are generally considered as moderately well-drained. These soils generally have a moderately fine texture to a moderately coarse texture with a moderate rate of water transmission. The soils are nearly level to gently undulating with numerous low, irregularly-shaped rises separated by shallow swales, drainage ways, and occasionally, poorly-drained depressions (wetlands). The soils are loam to clay-loam glacial till with occasional areas of sandy loam. The major soil associations in the eight-county area are:

Arvilla-Sioux-Divide
Barnes-Colvin
Barnes-Hamerly
Barnes-Svea
Barnes-Svea-Cresbard
Embden-Swenoda-Gardena
Gardena-Overly-Fargo
Hecla-Ulen
Manning-Lihen
Max-Williams
Max-Zahl
Miranda-Noonan
Wabek
Williams
Williams-Bowbells
Williams-Hamerly-Bowbells
Williams-Nioball
Williams-Zahl
Zahl-Max
Zahl-Max-Williams-Velva
Zahl-Williams

Prime Farmland

The United States Department of Agriculture defines prime farmland as areas with soils best suited to produce food, feed, forage, fiber, and oilseed crops. Prime farmland has soil properties that are considered favorable for economic production of sustained high crop yields with minimal energy input and economic resources with the least damage to the environment.

3.1.2 Environmental Consequences

Alternative A — Integrated System

Disturbances would include topsoil stripping and stockpiling, excavation for pipeline installation, stockpiling and placement of bedding material, and the installation of pipe. Topsoil would be stripped from all areas, including where pumping plants, reservoirs, and other facilities are to be constructed. Topsoil would be stripped down to the soil color change but to no greater depth than 12 inches. Topsoil would then be stored in an embankment parallel to the pipe trench along the outer portion of the temporary working space. The salvaged topsoil would be maintained separately and not mixed with any underlying soils. Topsoil would not be salvaged from narrow areas where the pipeline is to be installed by a trencher or plow.

No significant differences in impacts for the various pipeline diameters are anticipated, although the total area of soils directly impacted by trenching would increase slightly with the installation of larger diameter pipe. Impacts from vehicles, stockpiling of excavated material, and pipe laying would not differ significantly.

The potential for unstable back slopes is minimal. Special care would be taken during installation where pockets of sand and gravel are crossed. Within the eight-county project area, no active earthquake faults exist; the entire area lies in a low seismic risk zone (Seismic Zone 0).

With appropriate reclamation measures, long-term impacts to soils would be negligible. The critical element would be the preservation and re-spreading of topsoil on disturbed areas. Well-vegetated soils on the generally level to gently sloping areas (less than 2 percent slopes) would likely result in few reclamation problems.

If heavy rains or rapid snowmelt should occur during the reclamation process but before vegetation is well established, some short-term soil erosion could occur. This would likely occur primarily in exposed areas of sparse vegetative cover or on moderate to steep slopes. These areas of erosion would require treatment and revegetation. On cropland, a short-term reduction in soil productivity is anticipated because of soil compaction and possible damage to soil structure from vehicular traffic. Wind erosion could also be a problem on bare ground during winter or early spring.

Impacts to prime farmland were determined using acreage data provided by the United States Department of Agriculture, Major Land Resource Area Regional Soil Survey Office [1996]. Temporary impacts were calculated by multiplying the percent prime farmland for each county by the overall area impacted per county. Prime farmland impacted per segment was determined by adding county acreage estimates (Table 7). A total of 1,707 acres would be temporarily impacted by pipeline construction.

Table 7. Acres of prime farmland temporarily impacted by NAWS pipeline construction (Alternative A).

Segment Number	Counties Included	Acres Prime Farmland Temporarily Impacted
1	McLean, Ward	106
2	Ward, Renville, Bottineau	225
3	Bottineau	369
4	Bottineau	61
5	Bottineau	45
6	Bottineau	112
7	Bottineau	73
8	Renville	134
9	Renville, Ward, Burke	250
10	Burke, Divide	10
11	Divide	1
12	Williams	9
13	Ward	69
14	Ward, Mountrail	95
15	Bottineau	148
TOTAL		**1,707**

In addition to pipeline impacts, permanent facilities (pump stations and storage reservoirs) would be built that could permanently impact prime farmland. Wherever possible, prime farmland would be avoided for placement of permanent facilities. Where avoidance is not possible, the impacts of removing prime farmland would be assessed under the Farmland Protection Policy Act. This Act was passed by Congress to protect important farmland. Federal agencies must determine if their program would have adverse impacts on prime or unique farmlands, and if they do, the agency must consider alternative actions that would lessen the impact. Criteria are established by the federal government for agencies to follow in determining which alternative sites should receive the highest level of protection from conversion to non-agricultural uses. Once the general location of facilities for the selected alternative are determined, the managing agency would follow the guidelines for farmland protection, as published in the Federal Register [7 CFR Part 658]. If prime farmland is lost, a farmland conversion rating form [AD-1006] would be completed and processed through the Natural Resource Conservation Service.

Alternative B — Upgrade of Existing Systems

Little impact to topography would occur under implementation of Alternative B. Long-term impacts to soils would occur with construction of brine ponds and new water treatment plants, which would result in permanent changes to the landscape. Construction of both brine ponds and new water treatment plants would displace topsoil and result in the permanent loss of production on these areas. Prime farmland would be avoided when siting brine ponds and new water treatment plants where possible, but where it could not be avoided, the same procedure would apply to prime farmland assessment as described in Alternative A.

Temporary impacts to prime farmland by laying of pipelines from new groundwater wells to water treatment plants would occur near the communities of Bottineau, Bowbells, Noonan, Wildrose, Berthold, and Willow City. Approximately 25 acres of prime farmland would be disturbed by pipeline construction. Reclamation efforts would be similar to those listed for Alternative A.

Preferred Alternative — Combination of Alternatives A and B

Potential impacts caused by construction of the pipeline portion of a combination system would be similar to those listed for Alternative A. Construction and reclamation procedures would apply the same as described in Alternative A.

The estimated acreage of prime farmland temporarily impacted would be 1,604 acres. Since prime farmland would be avoided to the extent possible when selecting areas for brine ponds and new water treatment facilities in Grenora and Wildrose, no additional impacts to prime farmland would be expected. Because facility upgrades in Parshall would not require additional land, prime farmland would not impacted there.

No Action Alternative

No direct impacts would occur to geology, topography, and soils from taking the No Action Alternative to develop an eight-county water distribution system.

3.2 Water Resources

3.2.1 Affected Environment

Groundwater

Plentiful supplies of groundwater can be found in numerous locations within the eight-county area. At the present time, groundwater is the primary water source utilized by both municipal and private water systems. These supplies are generally found in glacial aquifers from which large quantities of groundwater could be developed. Smaller quantities of groundwater are available from bedrock aquifers and shallow alluvial aquifers. Shallow alluvial aquifers are greatly influenced by surface water recharge and are therefore subject to drought, which limits their recharge, and reduces the quantity and reliability of water available. Groundwater from glacial aquifers is generally considered poor in quality in comparison to Missouri River water. Many sources do not meet present and proposed EPA secondary drinking water standards. Glacial groundwater is generally considered hard and contains high levels of iron, manganese, sulfate, sodium, and chloride. Bedrock aquifers also generally yield water of poor quality with high sodium and dissolved solids content. Groundwater quality from shallow alluvial aquifers is somewhat better, but development potential of alluvial aquifers is generally not feasible because of low well yields and the potential for contamination from surface sources. Therefore, although groundwater supplies may be available to meet the needs of most of the potential users within the project area, treatment costs to meet EPA secondary drinking water standards would be higher in most situations when compared with surface water treatment costs and would be much less reliable in either quantity or quality. Groundwater supplies should be considered in those communities, however, where pipeline and pumping costs from the Missouri River are excessive.

Surface Water

Surface water sources are plentiful in northwestern North Dakota when considering the proximity of the Missouri River, Lake Sakakawea, and Lake Audubon. In addition to these sources, the Souris and Des Lacs Rivers provide a loop of surface water through the counties of Burke, Renville, Ward, McHenry, and Bottineau. The Souris/Des Lacs river system has good flows during most years, but during periods of moderate to severe drought, flows become very low and zero flows are not uncommon. There are currently 36 water permits on the Souris River and four water permits on the Des Lacs River, with an annual appropriation of approximately 31,500 acre-feet. In addition, in 1937 the U.S. Fish and Wildlife Service filed for water rights to all unallocated water generated in the Souris River basin for use by the Des Lacs, Upper Souris, and J. Clark Salyer National Wildlife Refuges.

The government of Saskatchewan has recently constructed two impoundments in the Souris River drainage basin: Rafferty, built in 1991; and Alameda, built in 1994. These dams have significantly influenced flows in the Souris River. The 1959 Interim Agreement to the 1909 Boundary Waters Treaty between the U.S. and Canada specified that Saskatchewan could retain 50 percent of the natural flow of the Souris River generated in Saskatchewan. North Dakota may use the 50 percent received from Saskatchewan plus the flow generated in North Dakota, except that twenty cubic feet per second (20 cfs) must flow into Manitoba during the months of June through October inclusively [6,069 acre-feet]. Until the dams were built, Saskatchewan was unable to divert its share of water under the agreement. Annex B to the *1989 Agreement Between the United States and Canada for Water Supply and Flood Control in the Souris River Basin* (Appendix C) specifies that, under certain conditions, a portion of the North Dakota share of flow will be in the form of evaporation from Rafferty and Alameda Reservoirs. When these conditions occur, Saskatchewan shall pass a minimum of 40 percent of the natural flow. Interested readers will find more information on the apportionment of flows on the Souris River in Appendix C. The construction of Rafferty and Alameda Dams will reduce the amount of water flowing in the Souris River past Minot and reduce its viability as a municipal water supply source. The Missouri River remains the most reliable source of surface water in the project area.

Both Alternative A and the Preferred Alternative propose to withdraw water from Lake Sakakawea, near the Snake Creek Pumping Plant or from Lake Audubon. Lake Audubon is a man-made impoundment which serves, in part, as an integral feature of the Garrison Diversion Unit (GDU), a federal irrigation and MR&I water project. As part of this project, water is pumped into Lake Audubon from Lake Sakakawea by the Bureau of Reclamation through the Snake Creek Pumping Plant. The NAWS system, which would be an integral part of the Garrison Diversion Unit project, would be eligible for preference power.

Based on available water quality data, Missouri River water from Lake Sakakawea or Lake Audubon could be characterized as good quality with high but acceptable dissolved mineral concentrations. It should be noted that while relatively mineralized, Missouri River water is normally significantly lower in hardness, TDS, sodium, and sulfates than the Souris and Des Lacs Rivers or than from any groundwater sources throughout the project area. Iron and manganese levels are also very low in Missouri River water compared to groundwater sources. Turbidity of Missouri River water would depend on the location of the intake structure on Lake Sakakawea or Lake Audubon. The turbidity of the water withdrawn from either Lake Sakakawea or Audubon would also depend upon wind direction, intake location, and seasonal influences.

Specific water quantity and quality data on both existing and proposed water sources are listed in the *1993 Community Needs Assessment* [Houston Engineering et al. 1993b] and were collected as part of the needs inventory compiled from the U.S. Geological Survey, State Water Commission, North Dakota Department of Health, and municipal data sources. Additional quality and quantity data are available from these agencies.

It is estimated that the NAWS project would, by the year 2010, have an annual demand of approximately 10,400 acre-feet to meet the projected demands of the NAWS service area, including the demand of the contract users detailed on Tables 4 and 5, plus rural needs in Bottineau, Burke, Divide, Renville, northern Williams, and Ward Counties. Water necessary to meet these demands could come from three potential sources: the Des Lacs/Souris River system, the Minot/Sundre aquifers, and the Missouri River system. Even based on current levels of development, the Des Lacs/Souris River system cannot be relied upon to supply the Integrated System due to the impoundment of the river in Canada, international appropriation agreements, senior water appropriations, and the drought-prone nature of the resource itself. The Minot and Sundre aquifers currently supply the City of Minot and the Minot Air Force Base with approximately 7,000 acre-feet annually, and a State Water Commission study indicates that the long-term yield of 10,400 acre-feet per year cannot be developed and could not serve an extended regional system.

The Sundre and Minot Aquifers are hydrologically connected to the Souris River. Before the 1970's, when Minot began to develop the Sundre Aquifer, the hydraulic gradient at some locations in the aquifer was towards the river, especially when river flows were low. With development of Minot's wells and the subsequent drop in groundwater levels, the gradient has changed so that it is now towards the wells and away from the river.

The Missouri River remains as the most reliable supply of water for the NAWS service area. It should be noted, however, that any and all of the alternatives would require a water appropriation permit from the State Engineer.

3.2.2 Environmental Consequences

Alternative A — Integrated System

The total supply requirement for the Integrated System of 10,400 acre-feet withdrawn annually would be taken from the Missouri River; this amount would represent approximately 0.065 percent of the annual flows through the Garrison Dam. The impacts to the Missouri River water supply are minimal under Alternative A.

The preliminary pipeline corridors would cross the Souris River three times and the Des Lacs River one time. Three of these crossings would be on National Wildlife Refuges in Bottineau, Ward, and Renville Counties and would require the development of special procedures to minimize impacts to the refuges. All refuge crossings could be made adjacent to State Highway 5 which would help minimize impacts. Several intermittent streams would also be crossed.

Where a pipeline crosses a major stream like the Souris or Des Lacs Rivers, construction techniques would be used which would minimize in-stream impacts. The best method to minimize impacts in cases like these would be to bore beneath the river; this technique would be employed when crossing perennial streams and for intermittent streams wherever feasible. If boring proves to be unfeasible, open trench methods would be employed and restrained joint pipe would be used in these trench installations. Sediment barriers would be erected to catch sediments released during construction. All stream crossings would be made during periods of low flows whenever possible to minimize impacts.

Where a pipeline crosses an intermittent stream and open trench construction through the bed of the stream is used, spoil from the trench would be stockpiled above the ordinary high-water mark. Restoration of disturbed channel bottoms and revegetation of the bank areas would be completed in a manner approved by the landowners and governmental management agencies. Revegetation or restoration of the bank areas would be done in a manner to minimize bank erosion.

Construction of pipelines across streams would result in minor, short-term impacts. Suspended sediment concentrations in flowing streams would increase immediately downstream from the crossing and would result in a temporary increase in turbidity. Planning construction during low flow periods or when intermittent streams are not flowing would reduce impacts.

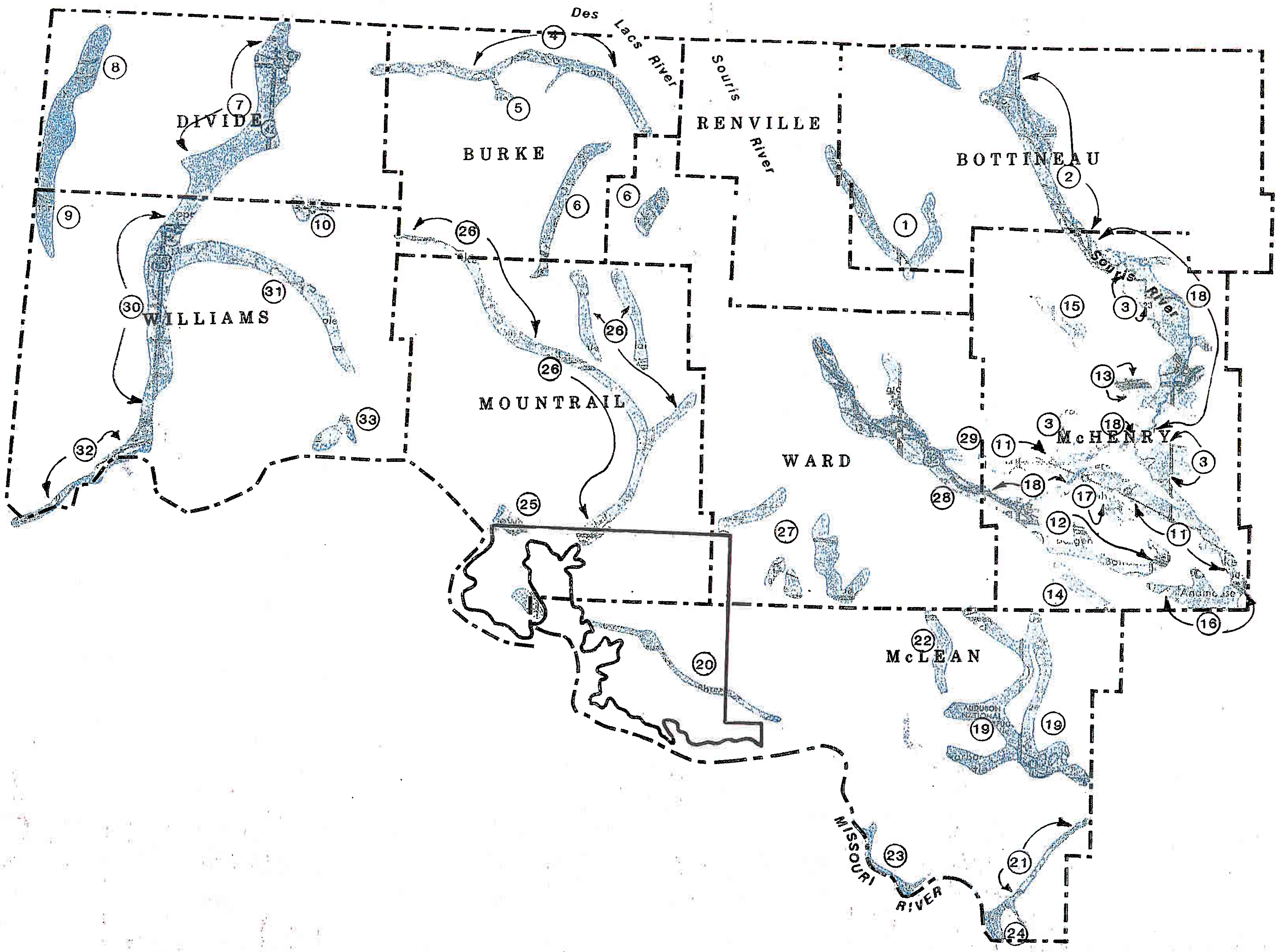
Impacts to groundwater aquifers from pipeline construction are not expected to occur; all major aquifers are well below the bottom of proposed pipeline trenching even in areas of deep cuts.

Alternative A would enhance surface water resources in the area by importing 10,400 acre-feet annually into the Souris River basin. A substantial amount of this water would eventually find its way into the Souris River through waste water discharges. This alternative would also reduce demands on the Minot and Sundre Aquifers, which would reduce the current hydrological gradient away from the Souris River, potentially to the point where flows are reversed and the Souris River would again be supplemented by the groundwater system. At a minimum, there would be a reduction in recharge from the Souris River to the aquifers. During periods of low flow, additional flows or reduced recharge of the aquifer would have a positive impact on the Souris River.

Alternative B — Upgrade of Existing Systems

Alternative B would require every NAWS contract user to obtain its own water from existing supplies. The groundwater supplies currently used by communities and rural water districts are primarily from glacial aquifers. In general, glacial aquifers contain good supplies of groundwater but are not always utilized or available. Figure 6 shows the locations of the major glacial aquifers located in the NAWS area.

Figure 6. Major glacial aquifers in the NAWS project area



LEGEND

1 - GLENBURN AQUIFER
2 - SOURIS VALLEY AQUIFER
3 - LAKE SOURIS AQUIFERS
4 - COLUMBUS AQUIFER
5 - LIGNITE CITY AQUIFER
6 - KENMARE AQUIFER
7 - BURIED YELLOWSTONE CHANNEL
8 - SKJERMO LAKE AQUIFER
9 - GRENORA AQUIFER
10 - WILDROSE AQUIFER
11 - NEW ROCKFORD AQUIFER SYSTEM
12 - VOLTAIRE AQUIFER
13 - DENBIGH AQUIFER
14 - BUTTE AQUIFER
15 - CUT BANK CREEK AQUIFER
16 - MARTIN AQUIFER SYSTEM
17 - KARLSRUHE AQUIFER
18 - SOURIS VALLEY AQUIFER
19 - LAKE NETTIE AQUIFER SYSTEM
20 - WHITE SHIELD AQUIFER
21 - LOST LAKE AQUIFER
22 - SNAKE CREEK AQUIFER
23 - FORT MANDAN AQUIFER
24 - PAINTED WOODS LAKE AQUIFER
25 - NEW TOWN AQUIFER
26 - SHELL CREEK AQUIFER SYSTEM
27 - COUTEAU DU MISSOURI AQUIFERS
28 - SOURIS RIVER AQUIFER SYSTEM
29 - SUNDRE AQUIFER SYSTEM
30 - LITTLE MUDDY AQUIFER
31 - RAY AQUIFER
32 - TRENTON AQUIFER
33 - HOFFLUND AQUIFER

0 5 10 15 20 30

SCALE IN MILES

Figure 6
Major Glacial Aquifers
in the NAWS Study Area

Brine concentrate, resulting from the reverse osmosis process in this alternative, would be disposed of in clay or membrane-lined evaporation ponds. Pond lining would prevent seepage of brine from the ponds into the aquifer systems. Brine concentrate is not classified as hazardous waste.

Any brine generated by Minot's water treatment plant would be processed through Minot's wastewater treatment facility and would result in a decrease in water quality from the plant's discharge to the Souris River. Total dissolved solids (TDS) would increase but would still meet national point discharge standards.

Sufficient groundwater quantities are available to contract users to prevent depletion of the groundwater resource. As a safeguard, a North Dakota statute prohibiting the depletion of groundwater supplies is enforced by the State Water Commission. This statute and its enforcement should ensure the prevention of any long-term adverse impacts to the local groundwater supplies from this development.

Use of the Sundre Aquifer for Minot's water would result in less discharge from the aquifer to the Souris River, which could reduce flows in the Souris River, especially during drought and low flow periods. The release from Minot's wastewater treatment plant would offset some of this loss of water from the Sundre Aquifer.

Under Alternative B, Parshall would continue to use Missouri River water from its existing intake. Its annual water demand from the Missouri River would be 1,090 acre-feet.

Preferred Alternative — Combination of Alternatives A and B

A combined system using groundwater and pre-treated Missouri River water would conserve groundwater resources and make maximum use of Missouri River water. Ninety-four percent of the water would come from the Missouri River, approximately 9,810 acre-feet annually; this amounts to approximately 0.06 percent of the annual Missouri River flows at Garrison Dam.

The removal of Grenora and Wildrose from the integrated system in Alternative A lowers the annual use of Missouri River water by 590 acre-feet. Because Parshall would continue to draw approximately 1,090 acre-feet annually from Lake Sakakawea under the Preferred Alternative, the amount of Missouri River water used by a combined system would be 9,810 acre-feet. This figure reflects no significant decrease from the 10,400 acre-feet required by the integrated system in Alternative A. The net result on the long-term flows of the Missouri River would thus be negligible.

The populations of Grenora and Wildrose are not projected to grow significantly over the next twenty years. The use of their existing groundwater supplies would not be impacted by the upgrading of their existing treatment facilities.

The net result of the Preferred Alternative on the water resources of the NAWS area is the same as that from the integrated system in Alternative A.

No Action Alternative

The No Action Alternative would not directly affect water resources. However, existing programs to develop water supplies from groundwater sources would continue to occur. Drought years would induce an increased demand on a scarcer surface water supply in certain areas. The impoundments in Canada and competition among permit users including the U.S. Fish and Wildlife Service for national wildlife refuges, communities, and irrigators, would place increased demands on a diminished supply of Souris River water.

3.3 Vegetation

3.3.1 Affected Environment

The proposed pipeline project area consists primarily of cultivated cropland interspersed with areas of mixed-grass prairie, planted grasslands, wetlands, and woodland areas. Each plant community is described separately in the following sections.

Cultivated Cropland

Cultivated crops found in the project area include small grains such as durum wheat, spring wheat, barley, oats, flax, and rye. Sunflowers, dry edible beans, corn, and other specialty crops are also grown in rotation with small grains.

The eight counties in the assessment area - Bottineau, Burke, Divide, McLean, Mountrail, Renville, Ward, and Williams - were ranked the top eight counties in North Dakota for production of durum wheat in 1995, with Ward County ranking first [North Dakota Agricultural Statistics Service 1996]. Ward and McLean Counties also ranked first and third, respectively, for total crop production of wheat.

Mixed-Grass Prairie

Mixed-grass prairie remains primarily as native rangeland with some undisturbed areas of native grassland scattered throughout the project area. The predominant vegetation of native rangeland is mid- and short-grasses and grass-like plants, both native and introduced. The vegetation is highly dependent on the local climate, topography, soil type, and grazing intensity. Common species include green needlegrass (*Stipa viridula*), western wheatgrass (*Agropyron smithii*), big bluestem (*Andropogon gerardii*), little bluestem (*Andropogon scoparius*), switchgrass (*Panicum virgatum*), needle-and-thread (*Stipa comata*), plains muhly (*Muhlenbergia cuspidata*), and side-oats grama (*Bouteloua curtipendula*). More saline soils are often vegetated by Nuttall alkaligrass (*Puccinellia nuttalliana*), slender wheatgrass (*Agropyron caninum majus*), alkali cordgrass (*Spartina gracilis*), and plains bluegrass (*Poa arida*) [U.S. Department of Agriculture, Soil Conservation Service 1974].

The mixed-grass prairie is also characterized by a variety of forb species. Some common species include wild onion (*Allium canadense*), prairie buttercup (*Ranunculus rhomboideus*), bladderpod (*Lesquerella ludoviciana*), torch flower (*Geum triflorum*), prairie wild rose (*Rosa arkansana*), lead plant (*Amorpha canescens*), white beardtongue (*Penstemon albidus*), golden aster (*Chrysopsis villosa*), and purple coneflower (*Echinacea angustifolia*) [Stewart 1975].

Planted Grassland

Planted grassland includes areas of planted rangeland, tame hayland, and Conservation Reserve Program land. Plant species composition of planted rangeland varies from one area to another. Recommended species for seeding of rangeland include big bluestem, blue grama (*Bouteloua gracilis*), green needlegrass, little bluestem, prairie sandreed (*Calamovilfa longifolia*), reed canary grass (*Phalaris arundinacea*), side-oats grama, slender wheatgrass, switchgrass, and western wheatgrass [U.S. Department of Agriculture, Soil Conservation Service 1981].

Tame haylands are characterized by the growing of domestic hay crops. Species suitability varies from one soil type to another and accordingly, from one region to another. In general, the following introduced species are recommended: intermediate wheatgrass (*Agropyron intermedium*), Russian wild rye (*Elymus junceus*), smooth brome (*Bromus inermis inermis*), tall wheatgrass (*Agropyron elongatum*), and crested wheatgrass (*Agropyron cristatum*). Native grasses such as green needlegrass, slender wheatgrass, thickspike wheatgrass (*Agropyron dasystachyum*), and western wheatgrass are also recommended [U.S. Department of Agriculture, Soil Conservation Service 1988].

Lands planted to Conservation Reserve Program are found occasionally throughout the eight-county project area. Plant species include both native and introduced grasses, as well as various legumes such as alfalfa and sweetclover. Species composition can vary depending on soil type but often includes smooth brome, crested wheatgrass, and intermediate wheatgrass. Other introduced grasses occasionally found in Conservation Reserve Program lands are Russian wild rye and tall wheatgrass. Native grasses recommended for Conservation Reserve Program planting include big bluestem, green needlegrass, Indian grass (*Sorghastrum nutans*), slender wheatgrass, and western wheatgrass. Invading weedy species consist of kochia (*Kochia* *scoparia*), Russian-thistle (*Salsola iberica*), and Canada thistle (*Cirsium arvense*) [U.S. Department of Agriculture, Soil Conservation Service 1990].

Woodlands

For purposes of this assessment, riverine woodlands, wooded draws, shelterbelts, and shrub land are all included in this category.

Also called floodplain forests, riverine woodlands are narrow strips of woody vegetation found adjacent to rivers and streams. Dominant species are cottonwood (*Populus deltoides*), green ash (*Fraxinus pennsylvanica*), and box elder (*Acer negundo*). Common herbaceous plants include wild four-o-clock (*Mirabilis nyctaginea*), Virginia wild rye (*Elymus virginicus*), carrion-flower (*Smilax herbacea*), baneberry (*Actaea rubra*), and fringed loosestrife (*Lysimachia ciliata*) [Stewart 1975].

Wooded draws are areas with moist microclimates in which small trees and tall shrubs dominate. The dominant species include bur oak (*Quercus macrocarpus*), green ash, box elder, American elm, buffaloberry (*Shepherdia argentea*), juneberry (*Amelanchier arborea*), silverberry (*Elaeagnus commutata*), Saskatoon service-berry (*Amelanchier alnifolia*), hawthorn (*Crateagus rotundifolia*), wild plum (*Prunus americana*), and chokecherry (*Prunus virginiana*).

Shelterbelts are planted woodlands used to protect farmsteads from severe winds and allow drifting snow to accumulate on growing areas. Both native and exotic trees are used in shelterbelts and commonly include Black Hills spruce (*Picea glauca*), ponderosa pine (*Pinus ponderosa*), American elm, box elder, and green ash [Stewart 1975]. Siberian pea-shrub (*Caragana arborescens*) and Russian olive (*Elaeagnus angustifolia*) are also frequently planted in shelterbelts.

Shrubland, composed mainly of juneberry, chokecherry, and hawthorn, was encountered along the periphery of a minor drainage in Segment 12. This type of vegetation was not seen in any of the other segments but was represented in the area between Lake Zahl and the town of Hanks.

Wetlands

Wetlands are described and assessed in Section 3.8.

Rivers and Streams

The Souris and Des Lacs Rivers within the proposed pipeline route are characterized by slow-moving water and mud bottoms. Many species of algae are found in the rivers and, as primary producers, constitute the base of the food chain. Many macroinvertebrates, including the larval stages of numerous terrestrial insects, feed on aquatic algae. However, the most prominent vegetation in the area is the riverine woodlands, as addressed in Section 3.3.1.

Rights-of-Way

Rights-of-way and roadsides provide narrow strips of habitat often containing planted grasses and forbs along with weedy species and occasional trees and shrubs. Generally, these areas are dominated by smooth brome grass and Kentucky bluegrass (*Poa pratensis*).

3.3.2 Environmental Consequences

Approximately ten percent of each of the proposed pipeline segments was surveyed to determine acreage of rangeland, hayland, cropland, and woodlands. One-mile sections from each segment were randomly selected and odometer readings were taken for each vegetation type located within the proposed pipeline corridor of 110 feet. Measured distances for pasture were then multiplied by the corridor width of 110 feet, while shelterbelts lengths were multiplied by an estimated average width of 50 feet (resource impacts are minimized through shelterbelts). This information was used to approximate the acreage likely to be impacted per segment if the pipeline is built as planned.

All segments, except Segment 15, were surveyed in the above-described manner. Since Segment 15 was added to the project after the environmental assessment field work was completed, aerial photographs of the entire area bordering the proposed pipeline segment were obtained from the Farm Service Agency of Bottineau County. These photographs were used to determine approximate acreage of native and tame pasture, and shelterbelts that would be impacted.

Cropland impacts were calculated using percentage of cropland per county as given in the 1992 Census of Agriculture. County data were added together accordingly to arrive at an acreage total for each segment. The impacts to Conservation Reserve Program land and hayland were similarly estimated using 1992 and 1993 acreage data from the Natural Resource Conservation Service [U.S. Department of Agriculture, Natural Resources Conservation Service 1993].

Permanent impacts to vegetation from placement and construction of permanent facilities were determined by calculating acreage that would be lost and extrapolating the proportion of vegetation types in the eight-county area to the area impacted.

Alternative A — Integrated System

Table 8 provides estimates of temporary impacts to vegetation from the proposed pipeline.

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Table 8. Estimated acreage of vegetation type impacted temporarily by Alternative A construction.

Segment Number	Counties Included	Total Impacted Acres [1]	Crop-land Acres	Hay-land Acres	CRP Acres	Native Range Acres	Tame Range Acres	Shelter-belts Acres	Woody Draws Acres	Riverine Woodland Acres
1	McLean, Ward	589.6	373.2	15.6	31.1	117.3	3.7	5.1	0.0	0.0
2	Ward, Renville, Bottineau	516.4	433.2	21.0	35.6	0.0	0.0	6.7	0.0	0.0
3	Bottineau	660.2	445.5	33.4	52.2	23.5	35.2	40.6	0.0	0.0
4	Bottineau	109.4	87.3	6.5	10.2	0.0	0.0	0.0	0.0	0.0
5	Bottineau	80.2	50.3	3.8	5.9	0.0	0.0	17.8	0.0	0.0
6	Bottineau	200.2	133.1	10.0	15.6	0.0	0.0	33.7	0.0	0.0
7	Bottineau	130.7	104.8	7.9	12.3	0.0	0.0	2.7	0.0	0.0
8	Renville	181.7	132.9	2.4	5.1	0.0	0.0	32.7	0.0	0.0
9	Renville, Ward, Burke	479.1	379.3	9.5	21.3	25.6	0.0	4.9	4.2	4.2
10	Burke, Divide	542.0	324.8	14.7	41.5	104.9	0.0	5.1	0.0	0.0
11	Divide	371.5	265.4	16.1	46.9	26.5	0.0	0.4	0.0	0.0
12	Williams	518.6	384.3	20.8	24.8	78.0	0.0	0.0	0.0	0.0
13	Ward	293.1	182.7	6.7	12.4	88.6	0.0	0.0	0.0	0.0
14	Ward, Mountrail	568.6	291.2	12.1	24.9	184.6	0.0	4.6	0.0	0.0
15	Bottineau	265.9	184.7	7.6	21.7	17.1	3.5	16.0	0.0	0.0
TOTAL		**5,507.1**	**3,772.8**	**187.8**	**361.6**	**666.1**	**42.5**	**170.3**	**4.2**	**4.2**

[1] Total acreage includes wetland acreage, which is provided in Table 13.

Construction of the proposed pipeline may cause the destruction of several shelterbelts or parts of shelterbelts. The majority of shelterbelts in the project area lie perpendicular to the route and should be minimally impacted, with the loss of a few trees. However, several shelterbelts that are planted parallel to the existing roads and along the main line would likely have to be removed completely. Every attempt possible would be made to avoid impacting these shelterbelts. Avoidance of these areas wherever possible when siting the routes would minimize the impacts to shelterbelts.

The only wooded draw encountered in sampling was in Segment 9 and had an approximate area of four acres. Although no other wooded draws were sampled in field work, it is possible that others may be encountered. Riverine woodlands were located within the Upper Souris National Wildlife Refuge in Renville County. The area potentially impacted by construction is four acres, all located within Segment 9.

Permanent vegetation loss would occur in areas where pumping stations and storage reservoirs are constructed. Each pumping station (27 total) would be approximately 800 square feet in area, with a combined total area of 0.5 acres of impact. Cropland (0.4 acres) represents the majority of the area impacted, with native rangeland (0.1 acres) being second, and with minor impacts occurring on other cover types.

Storage reservoir impacts would vary depending upon the type of reservoir (steel or concrete) and the storage capacity of the reservoir. Six cylindrical steel reservoirs would be constructed above ground with storage volumes ranging from 0.1 million gallons to 0.5 million gallons. For purposes of this assessment, it was assumed that each steel reservoir would have a diameter of 75 feet and would impact approximately 0.4 acres of vegetation. The total impact for the six steel reservoirs would be 2.4 acres. Impacts would likely occur on cropland (1.6 acres), hayland (0.2 acres), Conservation Reserve Program land (0.2 acres), native rangeland (0.3 acres), and shelterbelts (0.1 acres).

Five concrete reservoirs are proposed. The two larger reservoirs, 3.0 million gallons and 6.5 million gallons, would each cover approximately 40,000 square feet. The three smaller reservoirs, 1.5 million gallons, 1.5 million gallons, and 0.5 million gallons, would each occupy 10,000 square feet. The combined impact of all concrete reservoirs would be 110,000 square feet or 2.5 acres. Impacts would likely occur on cropland (1.7 acres), hayland (0.1 acres), Conservation Reserve Program land (0.2 acres), native rangeland (0.4 acres), and shelterbelts (0.1 acres).

The retention and respreading of topsoil would be the key element in reducing cropland impacts. It is estimated that one year's agriculture production would be lost on approximately 13 acres per mile of pipeline installed. Topsoil would be stripped from all affected areas prior to installation of pipeline or related facilities. After construction, the topsoil would be respread and the areas tilled to reduce compaction caused by equipment during construction. Lost production impacts would be compensated through the price paid for the project right-of-way.

When system facilities are constructed across rangeland or prairie, disturbance and the amount of right-of-way would be kept to a minimum. Topsoil would also be stripped and stockpiled prior to construction. Upon completion of construction, the area would be leveled, topsoiled, seeded, and mulched. The seed mixture would include a blend of cool- and warm-season grasses approved by the appropriate landowner or managing agency. The effectiveness of revegetation would be monitored throughout the first growing season following construction. Eroded and unvegetated areas would be restored through remedial measures such as regrading, reseeding, and mulching. Revegetation would be completed to the satisfaction of the landowner or managing agency.

Weeds are efficient at colonizing areas from which grassland vegetation has been removed or disturbed. Where weeds grow adjacent to the rights-of-way, they would rapidly invade the disturbed, reseeded areas. In order to control the spread of weeds, the rights-of-way would be mowed to prevent the weeds from going to seed and to better allow native grasses to become established. Herbicides such as dicamba or 2,4-D would possibly be used to control weeds. These types of herbicides selectively kill broad-leaf plants and generally do not harm grasses when used at recommended rates.

Prior to construction, trees would be removed and the topsoil stripped. Upon completion of construction, the area would be re-topsoiled and replacement trees would be planted off site at a mitigation area. Trees would be replaced at a ratio of two trees planted for every one tree lost. The replacement species would be determined by the landowner or managing agency. The area would be monitored for a period of three years to ensure the replacement trees were established and dead or dying trees were replaced. Weeds would be controlled by cultivation (weeding), application of selected herbicides and mowing. The re-establishment of trees is a lengthy process which would require the constant attention of the project sponsors.

Landowners enrolled in the Conservation Reserve Program would need clearance from their county Farm Service Agency office before any temporary or permanent disturbance from the pipeline or facility construction could occur. Construction locations and specifications would be placed on file in the Farm Service Agency office, and the Natural Resources Conservation Service would provide specifications to reshape and reseed disturbed acreage.

Mitigation requirements would be determined by the Interagency Mitigation Assessment (IMA) team who would field review the locations of planned facilities. This team would consult with the Natural Resources Conservation Service and other agencies as necessary. The revegetation of disturbed areas that do not require mitigation would be determined by Reclamation in consultation with the State Water Commission, Natural Resources Conservation Service, landowners, and land management agencies.

Alternative B — Upgrade of Existing Systems

Table 9 provides the estimated permanent vegetation impacts for Alternative B.

Vegetation would be permanently removed in areas selected for the construction of brine ponds and new water treatment plants. Brine ponds would likely be located on cropland or rangeland. Wetlands and prime farmland would be avoided to the extent possible.

Additional temporary impacts would be caused by pipeline construction. For purposes of this assessment, it was assumed that construction of the pipeline would temporarily disturb a width of 100 feet, resulting in an overall disturbance of 95.1 acres. Estimated acreage impacted by vegetation type or land use pattern are as follows:

Cropland	64.8 acres	Hayland	3.3 acres
CRP	6.2	Native range	12.4
Tame range	1.0	Shelterbelts	7.2
Woody draws	0.0	Riverine woodlands	0.00

The same construction and reclamation procedures would be followed for impacts from pipeline construction as described in Alternative A.

Table 9. Estimated acreage of vegetation type permanently impacted by construction of Alternative B.

Communities	Permanently Impacted Acres	Cropland Acres	Hayland Acres	CRP Acres	Native Range Acres	Tame Range Acres	Shelterbelts Acres	Wooded Draw Acres	Riverine Woodlands Acres
Minot	110.0	76.8	2.8	5.2	24.2	0.0	1.0	0.0	0.0
Bottineau	83.8	54.4	4.1	6.3	5.0	1.0	12.9	0.0	0.0
Mohall	32.4	26.6	0.5	1.0	2.3	0.3	1.7	0.0	0.0
Souris	2.2	1.4	0.1	0.2	0.1	0.0	0.3	0.0	0.0
Westhope	26.2	17.0	1.3	2.0	1.6	0.3	4.0	0.0	0.0
Sherwood	46.5	38.1	0.7	1.5	3.3	0.5	2.5	0.0	0.0
Bowbells	27.1	17.7	0.8	2.2	5.2	0.6	0.6	0.0	0.0
Noonan	5.6	3.7	0.2	0.6	0.9	0.1	0.1	0.0	0.0
Columbus	11.5	7.5	0.3	0.9	2.2	0.2	0.2	0.0	0.0
Wildrose	10.5	6.6	0.4	0.4	2.9	0.2	0.0	0.0	0.0
Grenora	6.3	4.0	0.2	0.3	1.7	0.2	0.0	0.0	0.0
Berthold	50.5	35.7	1.3	2.4	11.1	0.0	0.0	0.0	0.0
Parshall	NO BRINE POND WOULD BE CONSTRUCTED								
Willow City	10.8	7.0	0.5	0.8	0.7	0.2	1.6	0.00	0.00
All Seasons I	71.4	46.3	3.5	5.4	4.3	0.9	11.0	0.00	0.00
All Seasons II	5.3	3.4	0.3	0.4	0.3	0.1	0.8	0.00	0.00
All Seasons III	18.6	12.1	0.9	1.4	1.1	0.2	2.9	0.00	0.00
Upper Souris I	40.8	26.7	1.2	3.3	7.9	0.9	0.9	0.00	0.00
Upper Souris II	26.4	17.1	1.3	2.0	1.6	0.3	4.1	0.00	0.00
TOTAL	**585.9**	**402.1**	**20.4**	**36.3**	**76.4**	**6.0**	**44.6**	**0.00**	**0.00**

Preferred Alternative — Combination of Alternatives A and B

Table 10 provides the estimated temporary impacts for the Preferred Alternative. The same construction and reclamation procedures would be followed for impacts from pipeline construction as described in Alternative A.

Additional permanent impacts are similar to those listed in Alternative A. Thirteen pumping stations would be built impacting approximately 0.2 acres. Concrete storage reservoirs would impact 2.5 acres, the same as listed for Alternative A. Steel reservoirs built near Berthold, Upper Souris I, and Bowbells, would impact approximately 1.2 acres. Permanent impacts would also be experienced by construction of brine ponds near Wildrose and Grenora. These impacts are 10.5 acres and 6.3 acres, respectively. Since the upgrade of Parshall's facilities would not include the construction of a brine pond, no additional impacts to vegetation would occur in Parshall.

Permanent loss is estimated to occur to cropland (13.3 acres), hayland (0.7 acres), Conservation Reserve Program land (1.1 acres), native rangeland (4.9 acres), and woodlands (0.7 acres). Wetlands and prime farmland would be avoided whenever possible.

No Action Alternative

The No Action Alternative would create no adverse impacts to vegetation.

3.4 Wildlife

3.4.1 Affected Environment

As previously indicated, the eight-county area is primarily agricultural lands interspersed with mixed-grass prairie, wetlands, and woodland habitat. The majority of the project area lies within the Prairie Pothole Region, the primary waterfowl-producing area in the State of North Dakota.

Small game species found within the proposed pipeline area include sharp-tailed grouse (*Tympanuchus phasianellus*), gray partridge (*Perdix perdix*), ring-necked pheasant (*Phasianus colchicus*), mourning dove (*Zenaida macroura*), ruffed grouse (*Bonasa umbellus*), and wild turkey (*Meleagris gallopavo*).

Shorebirds, ducks, geese, and other waterfowl are common, with large numbers of geese and ducks migrating through the area during spring and fall. The Missouri Coteau region and the Souris River Valley provide important breeding habitat for 12 species of waterfowl. Availability of shallow wetlands and upland cover provides excellent nesting and rearing habitat for these species.

Table 10. Estimated acreage of vegetation type temporarily impacted by construction of the Preferred Alternative.

Segment number	Counties Included	Total Impacted Acres [1]	Crop-land Acres	Hay-land Acres	CRP Acres	Native Range Acres	Tame Range Acres	Shelter-belts Acres	Woody Draws Acres	Riverine Woodlands Acres
1	McLean, Ward	589.6	373.2	15.6	31.1	117.3	3.7	5.1	0.0	0.0
2	Ward, Renville, Bottineau	516.4	433.2	21.0	35.6	0.0	0.0	6.7	0.0	0.0
3	Bottineau	660.2	445.5	33.4	52.2	23.5	35.2	40.6	0.0	0.0
4	Bottineau	109.4	87.3	6.5	10.2	0.0	0.0	0.0	0.0	0.0
5	Bottineau	80.2	50.3	3.8	5.9	0.0	0.0	17.8	0.0	0.0
6	Bottineau	200.2	133.1	10.0	15.6	0.0	0.0	33.7	0.0	0.0
7	Bottineau	130.7	104.8	7.9	12.3	0.0	0.0	2.7	0.0	0.0
8	Renville	181.7	132.9	2.4	5.1	0.0	0.0	32.7	0.0	0.0
9	Renville, Ward, Burke	479.1	379.3	9.5	21.3	25.6	0.0	4.9	4.2	4.2
10	Burke, Divide	542.0	324.8	14.7	41.5	104.9	0.0	5.1	0.0	0.0
11	Williams (WILDROSE)	2.3	1.5	0.1	0.1	0.6	0.1	0.0	0.0	0.00
12	Williams (GRENORA)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	Ward	293.1	182.7	6.7	12.4	88.6	0.0	0.0	0.0	0.0
14	Ward, Mountrail (PARSHALL)	UPGRADE OF EXISTING FACILITIES								
15	Bottineau	265.9	184.7	7.6	21.7	17.1	3.5	16.0	0.0	0.0
TOTAL		4,057.0	2,837.4	139.2	265.4	379.4	42.8	165.3	4.2	4.2

[1] Total acreage includes wetland acreage, which is provided in Table 13.

Area birds of prey include the turkey vulture (*Cathartes aura*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), prairie falcon (*Falco mexicanus*), burrowing owl (*Athene cunicularia*), great horned owl (*Bubo virginianus*), golden eagle (*Aquila chrysaetos*), and snowy owl (*Nyctea scandiaca*).

Numerous songbirds inhabit the area to include horned lark (*Eremophila alpestris*), western meadowlark (*Sturnella neglecta*), savannah sparrow (*Passerculus sandwichensis*), grasshopper sparrow (*Ammodramus savannarum*), clay-colored sparrow (*Spizella pallida*), lark bunting (*Calamospiza melanocorys*), vesper sparrow (*Pooecetes gramineus*), and American goldfinch (*Carduelis tristis*) [Stewart 1975].

White-tailed deer (*Odocoileus virginianus*) and pronghorn antelope (*Antilocapra americana*) are common big-game mammals in the project area. Mule deer (*Odocoileus hemionus*) and moose (*Alces alces*) are found in smaller numbers. White-tailed deer are generally found in areas with woods and in wetlands with dense emergent vegetation. White-tailed deer thrive in areas containing a good mix of farmland and native habitat. Pronghorn antelope use native prairie, rangeland, and cropland as habitat. Moose inhabit the Turtle Mountains and occasionally are found in the Souris River Valley. Mule deer occur primarily in Mountrail and Williams Counties.

Small and medium sized mammals found in the project area include furbearers such as mink (*Mustela vison*), muskrat (*Ondatra zibethicus*), white-tailed jackrabbit (*Lepus townsendii*), badger (*Taxidea taxus*), red fox (*Vulpes vulpes*), striped skunk (*Mephitis mephitis*), beaver (*Castor canadensis*), racoon (*Procyon lotor*), long-tailed weasel (*Mustela frenata*), eastern cottontail (*Sylvilagus floridanus*), snowshoe hare (*Lepus americanus*), fox squirrel (*Sciurus niger*), and coyote (*Canis latrans*).

Many species of reptiles and amphibians are common to the eight-county project area. Reptiles include the western painted turtle (*Chrysemys picta belli*), common snapping turtle (*Chelydra serpentina*), common garter snake (*Thamnophis sirtalis*), plains garter snake (*Thamnophis radix*), redbelly snake (*Storeria occipitomaculata*), smooth green snake (*Opheodrys vernalis*), western hognose snake (*Heterdon nasicus*), bullsnake (*Pituophis catenifer*), racer (*Coluber constrictor*), and prairie rattlesnake (*Crotalus viridis*). The Plains spadefood toad (*Scaphiopus bombifrons*), Woodhouse's toad (*Bufo woodhousei*), Great Plains toad (*Bufo cognatus*), Canadian toad (*Bufo hemiophrys*), northern leopard frog (*Rana pipiens*), wood frog (*Rana sylvatica*), western chorus frog (*Pseudacris triseriata*), and tiger salamander (*Ambystoma tigrinum*) are common amphibians.

3.4.2 Unique Wildlife Habitats

Saline Lakes

Saline lakes are large shallow basins containing high salinity water with exposed alkali salt flats. Little or no emergent vegetation is found in or around these lakes due to the high salinity. Widgeon grass (*Ruppia maritima*) is a submergent aquatic species in saline lakes. This barren habitat is home to the American avocet (*Recurvirostra americana*), piping plover (*Charadrius melodus*), killdeer (*Charadrius vociferus*), willet (*Catoptrophorus semipalmatus*), marbled godwit (*Limosa fedoa*), and Wilson's phalarope (*Phalaropus tricolor*).

A federally threatened species, the piping plover, is often associated with saline lakes and potential impacts to it are discussed in Section 3.7, Threatened and Endangered Species.

3.4.3 Environmental Consequences

Alternative A — Integrated System

Impacts of this alternative to wildlife would occur primarily during the construction of pipelines, pumping stations, and reservoirs. Impacts to large and mobile animals like deer, fox, antelope, and coyote would be of short duration, since construction would be confined to a narrow corridor and progress rapidly.

Construction of pumping plants and reservoirs would result in lost wildlife habitat (about 5 acres) to these facilities. Lost habitat would be replaced as determined by the Impact Mitigation Assessment team and in accordance to agreements with landowners and appropriate land managing agencies.

The nesting grounds of sharp-tailed grouse, found primarily in the broken or hilly terrain of native grasslands and upland coulees, could be affected during construction of the buried pipelines. Attempts would be made to avoid disturbance to leks during the breeding season of April through mid-May. Impacts to other avian populations, such as pheasant, gray partridge, shorebirds, waterfowl, and songbirds would be mostly short-term and would not affect the long-term viability of their populations. Loss of wetlands, woodlands, and riparian habitats would be minimized and mitigation measures would ensure no long-term impacts to wildlife.

Some small mammals, reptiles, and amphibians may be destroyed during construction; however, this loss would not be expected to affect the long-term viability of these species.

Electrical transmission lines pose hazards to raptors and migrating waterfowl. However, it is not anticipated that there should be a need to construct additional electrical transmission lines for the project. If additional transmission line construction occurs, the guidelines provided in Olendorff et. al. [1981] would be followed.

Alternative B — Upgrade of Existing Systems

Impacts to wildlife under this alternative would be from loss of habitat (about 180 acres) due to the addition of new water treatment facilities and brine ponds. Lost habitat would be replaced as determined by the Impact Mitigation Assessment team and in accordance to agreements with landowners and appropriate land managing agencies.

Wetlands would be avoided whenever possible, but where it is not possible to avoid them, they would be replaced on an acre-for-acre basis with ecological equivalency. Woodlands would be avoided whenever possible, but where they cannot be avoided, they would be replaced through mitigation at a ratio of 2 to 1.

Brine ponds could be utilized by waterfowl or shorebirds, but likely would not provide adequate habitat for breeding birds, nor should they pose a hazard to waterfowl or shorebirds.

Preferred Alternative — Combination of Alternatives A and B

Pipeline construction impacts for the Preferred Alternative would be similar to those listed for Alternative A. Approximately 7.5 acres of wildlife habitat would be lost from the construction of permanent facilities. Lost habitat would be replaced as determined by the Impact Mitigation Assessment team and in accordance to agreements with landowners and appropriate land managing agencies. Since no additional construction is required for the upgrade of facilities in Parshall, impacts to wildlife would not occur there. Avoidance and mitigation of wetlands and woodlands would occur as noted in Alternative B above.

No Action Alternative

The No Action Alternative would have no adverse effect to wildlife or to wildlife habitat.

3.5 Fisheries

3.5.1 Affected Environment

Productive fisheries are found in Lake Audubon, Lake Sakakawea, and the Missouri River above Lake Sakakawea. In recent years, 36 fish species have been collected in the Missouri system in North Dakota. The primary sport fishery in these waters is walleye (*Stizostedion vitreum*), northern pike (*Esox lucius*), paddlefish (*Polyodon spathula*), sauger (*Stizostedion canadense*), white bass (*Morone chrysops*), yellow perch (*Perca flavescens*), channel catfish (*Ictalurus* *punctatus*), and introduced salmonids such as coho salmon (*Oncorhynchus kisutch*), chinook salmon (*Oncorhynchus tshawytscha*), lake whitefish (*Coregonus clupeaformis*), brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), and lake trout (*Salvelinus namaycush*). Non-game species of interest include emerald shiner (*Notropis atherinoides*), Iowa darter (*Etheostoma exile*), creek chub (*Semotilus atromaculatus*), and flathead chub (*Platygobio gracilis*). Rainbow smelt (*Osmerus mordax*), a non-native species, were stocked in Lake Sakakawea in 1971, and have since become well-established throughout the Missouri River system in North Dakota. A spring smelting season has subsequently developed on streams flowing into Lake Sakakawea.

The pallid sturgeon (*Scaphirhynchus albus*), North Dakota's only federally-listed endangered fish species, is also found in the area. Impacts to pallid sturgeon are described in Section 3.7, Threatened and Endangered Species. The sicklefin chub (*Macrohybopsis meeki*) and the sturgeon chub (*Macrohybopsis gelida*), both known to exist in fair numbers in the upper Missouri. The U.S. Fish and Wildlife Service has determined that listing is not warranted at present but that these species may be listed as threatened or endangered in the future. These three species have been found in Lake Sakakawea, but their preferred habitat is flowing waters of the Missouri River and its larger tributaries.

The Souris River also supports an established fishery. Lake Darling on the upper Souris supports a good yellow perch, walleye, and northern pike sports fishery. J. Clark Salyer National Wildlife Refuge, located near the Canadian border, is noted as a productive waterfowl marsh. Periodic low flows and subsequent anoxic conditions in J. Clark Salyer subject fish to winter kills.

Numerous small bodies of water located throughout the project area provide fish habitat and some sport fishing opportunities. However, the majority of streams encountered are intermittent and therefore, do not contain significant fisheries. They may be important as spawning and nursing areas for the larger lakes, streams, and reservoirs during spring flows.

Appendix D contains a list of fish species found within the project area. This list shows which species are present in the Missouri River basin (Lake Sakakawea), the Souris River of North Dakota, and the Hudson Bay basin (south basin of Lake Winnipeg).

3.5.2 Environmental Consequences

Alternative A — Integrated System

Impacts to aquatic species could occur where pipelines cross rivers or streams. The pipeline would cross approximately 147 intermittent streams and 4 perennial streams (see Appendix E). Increased sedimentation could occur downstream of the crossings during and immediately following construction; however, impacts would be minor and of short duration. Project area streams normally have high sediment levels during runoff periods and resident fish species have adapted to this condition. Pipelines would be bored under perennial streams to minimize sedimentation impacts. Attempts would be made to bore intermittent streams, but where they cannot be bored, open-cut stream crossings would be undertaken, when possible, during periods of low or no flows and would avoid spawning periods. This policy would reduce environmental impacts as well as reduce construction costs.

Diversion of Missouri River water would have a negligible effect on flows and water quality of the Missouri River system in North Dakota, so therefore would not impact fisheries. Current projections are for the pipeline to withdraw an average 9.31 mgd, which translates to 28.5 acre-feet per day or 10,400 acre-feet per year. This represents approximately 0.065 percent of the average annual flows through the Garrison Dam, or 0.056 percent of the average annual storage in Lake Sakakawea.

Spillage of pre-treated water could impact fisheries or aquatic communities if a line break occurs near an intermittent or perennial stream, or into a lake such as Lake Audubon. Pre-treated water would have concentrations averaging 0.5 mg/L (for ozone pre-treatment) or 3.5 mg/L (for chlorine/chloramine pre-treatment), which exceed the acceptable acute values of total residual chlorine for most fish and invertebrate species [U.S. Environmental Protection Agency 1985]. Introduction of pre-treated water into local bodies of water would likely result in fish mortality near the source of the leak. Dilution effects would reduce chloramine concentration and impacts would decrease as distance from the source increases. Impacts would also be reduced if spilled water had to travel overland before reaching a stream or other body of water. The entire pipeline system would be monitored with a computerized data acquisition system to enable quick detection of any pipeline rupture and minimize the amount of water released.

Entrainment of fish eggs, larval fish, and small aquatic organisms through the intake structure could have a local impact on fisheries. Small organisms cannot resist the flow of water into a pipeline and could get sucked into the pipe with the water. It is important to place the pipe in a location that minimizes entrainment and to also have a slow water intake velocity. In general, identification of a suitable intake location should include the following considerations:

- avoidance of important spawning areas, juvenile rearing areas, or any other locations where field investigations have indicated the existence of a particular concentration of aquatic life;
- selection of a water depth where aquatic life is minimal, which may change seasonally or diurnally;
- selection of a location with respect to the river current where a strong current can assist in carrying aquatic organisms past the intake area or the face of screens;

- selection of a location suited to the proper technical functioning of the screening system to be used [United States Environmental Protection Agency 1976].

The U.S. Army Corps of Engineers provides guidelines for water intake structures under their permitting process. The guidelines, as listed below, would be followed if construction of the NAWS pipeline should occur:

- Intakes must be screened and maintained with material having a maximum mesh opening of one-quarter (¼) inch. The screens should be inspected and replaced if the screen has deteriorated.

- Intake velocities would not exceed 0.5 feet per second.

- The intake opening would be positioned three to five vertical feet above the bottom of the river or reservoir bed to minimize the entrainment of bottom-dwelling fish.

- If the intake lines are to be buried beneath the riverbed, the trench shall be backfilled to the original contours of the riverbed.

Intake Option 7: Construction and use of this shallow water intake in water less than 20 feet deep would increase the probability of the introduction of fish eggs and larval fish into the system.

Intake Option 8: This alternative would have an intake from five feet below the surface if Lake Sakakawea is at its minimum pool elevation of 1775 feet msl to about 84 feet below the surface if Lake Sakakawea is at its maximum pool elevation of 1854 feet msl. The intake structure would lie from 80 to 67 feet below the surface when Lake Sakakawea is operated at the normal pool elevation of 1837 to 1850 feet msl. Larval fish mortality would be greatly reduced when the intake structure is 84 feet below the surface, but would increase as water levels in Lake Sakakawea decrease to 1795 feet or lower.

Intake Option 11: This intake option would be about 55 feet below the water surface when Lake Audubon is at its operating elevation of 1845 to 1847 feet msl, reducing larval fish and fish egg mortality.

Intake facilities would follow guidelines of the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers to minimize impacts.

Alternative B — Individual System Upgrades

Water needs in the Minot area would be filled from both groundwater and surface water. During dry periods, surface water from the Souris River could be depleted, which would negatively affect reproduction and survival of fish. In addition, depletion of the Sundre aquifer would have a negative impact on flows of the Souris River, which would also negatively impact the fishery in that river.

The quality of water discharged from the Minot wastewater treatment plant would decrease but still meet point source standards. This could negatively impact fish in close proximity to the discharge point, but it would not likely affect viability of fish populations in the Souris River.

No new intake structures would be built under Alternative B. Minot's existing intake structure would be used for taking water from the Souris River. The intake pipeline on the Parshall system would be extended into deeper water, so entrainment would decrease.

Preferred Alternative — Combination of Alternatives A and B

Impacts from stream crossings would be the same as Alternative A, except fewer streams would be crossed by the pipeline, thus reducing the total temporary impact from sedimentation. Table E1 in Appendix E shows the number of intermittent and perennial stream crossings for Alternative A. Relative impacts of the Preferred Alternative can be assessed by omitting Segments 11, 12, and 14. Thirty-eight intermittent stream crossings would be avoided by upgrading systems in Parshall, Wildrose, and Grenora.

Stream crossings could be encountered with pipelines from new wells to water treatment plants. Sedimentation impacts caused by construction would be similar to those listed for Alternative A. New water treatment facilities and brine evaporation pond would not be located on or near stream crossings, therefore minimizing impacts to fisheries.

Impacts caused by the construction of intake facilities for the pre-treatment plant would be the same as those previously listed for Alternative A. The intake pipeline for Parshall would be extended to deeper water, minimizing fish mortality impacts from that facility.

The impacts from diversion of water would be the same as Alternative A. The impacts from potential line breaks and spillage of treated water would also be the same as discussed in Alternative A.

No Action Alternative

Water needs in the Minot area would be filled from both groundwater and surface water. During dry periods, surface water from the Souris River could be depleted, which would negatively affect reproduction and survival of fish.

The No Action Alternative would not require the construction of any additional intake facilities.

3.6 Interbasin Biota

3.6.1 Affected Environment

For purposes of this environmental assessment, interbasin biota transfer is the transfer, through man-made structures, as well as through natural processes, of life forms from one watershed drainage basin to another. Transferred life forms of concern can include viruses, bacteria, protozoans and other invertebrates, fish, fish eggs and other aquatic organisms, as well as macrophytic plants and algae. Introduction of different species from one basin to another can result in replacement of native or other desirable species with less desirable ones. Transfer of infected fish, protozoans, parasites, viruses, and bacteria can also result in fish diseases and epizootics to native flora or fauna with long-term implications. There are many documented cases of interbasin biota transfer; the most recently well publicized situation is the introduction of zebra mussel into the Great Lakes and other regions of North America from Europe. Other well known examples include rainbow smelt, introduced into the Great Lakes early this century and now established in Lake Winnipeg, and the Eurasian water milfoil, which has created problems in Minnesota and other parts of the Midwest.

Direct connection through water is only one of several possible ways for biota to be transferred between basins. Many vectors, or pathways, have been identified including attachment to birds, insects, through fish-stocking programs, transfer of biota in live wells and bilge water of recreational or commercial water craft, and through live bait transport. Whether an introduction of a non-native species or pathogen occurs through deliberate, natural, or accidental means, the results can be the same. When provided with suitable climate and favorable physical, chemical and biological conditions, introduced plants, animals or pathogens may establish themselves and proliferate within ecosystems, with potentially serious environmental consequences. The sponsors and cooperators of the NAWS project recognize the importance of maintaining a barrier to transfer of biota from the Missouri River basin into the Hudson Bay basin.

The potential for interbasin biota transfer within the Garrison Diversion Unit in North Dakota has been identified as a concern to Canada since the 1960s. The 1909 Boundary Waters Treaty is the basis for continuing consultations on water matters of mutual concern to both Canada and the United States. Article IV of the international treaty states that neither country will construct or maintain projects that will change the level or the flow of water crossing the international boundary unless approved by the International Joint Commission. It further states that the waters flowing across the boundary shall not be polluted on either side to the injury or property of the other. Canada, in a diplomatic note in October 1973, requested "that the Government of the United States establish a moratorium on all further construction of the Garrison Diversion Unit until such time as the United States and Canadian Governments could reach an understanding that Canadian rights and interests have been fully protected in accordance with the provisions of the Boundary Waters Treaty [Garrison Joint Technical Committee, November 1990a]."

Transfer of biota from the Missouri River basin into the Hudson Bay basin via the Souris River and its tributaries is the concern associated with interbasin biota transfer for NAWS. Ultimately, the Missouri River basin drains south to the Gulf of Mexico while the Hudson Bay basin drains north into the Hudson Bay. The NAWS pipeline, from the intake structure of the Missouri River basin to the Minot water treatment plant (Segment 1), and from Noonan to Wildrose (Segment 11), crosses the divide between the Missouri River basin and the Hudson Bay basin (Figure 2).

Table 11 provides a list of known problem fish species and a brief explanation regarding their current distribution within the NAWS project area. Other problem species such as pathogens are not as well known and, therefore, not readily listed.

3.6.2 Background of United States-Canada Consultations and Studies

The governments of Canada and the United States established the U.S.- Canada Consultative Group in the spring of 1981 to address the issue of return flows from the Garrison Project into Canadian waters. At its November 21, 1983 meeting, the U.S.-Canada Consultative Group established the Garrison Joint Technical Committee to examine Canadian concerns regarding the development of the Garrison Diversion Unit.

The Garrison Joint Technical Committee consists of federal representatives from Canada and the United States as well as provincial and state representatives. The Joint Technical Committee assesses Canadian technical concerns regarding the Garrison Diversion Unit and develops recommendations to the Consultative Group on whether and how such project features might proceed without adverse consequences for waters flowing into Canada. The Joint Technical Committee established Engineering and Biology Task Groups to assist them in addressing these issues, including those relating to the MR&I components of the Garrison Project.

Table 11. Fish species of concern associated with GDU and their distribution in the NAWS project area.

Common Name	Scientific Name	Distribution
Pallid sturgeon	*Scaphirhynchus albus*	Found in upper end of Lake Sakakawea but not in Souris River
Shovelnose sturgeon	*Scaphirhynchus platorynchus*	Found in the upper end of Lake Sakakawea and in riverine areas above Lake Sakakawea but not in the Souris River
Paddlefish	*Polyodon spathula*	Found throughout Lake Sakakawea and riverine areas above Lake Sakakawea but not in the Souris River
Shortnose gar	*Lepisosteus platostomus*	Found in Lake Sakakawea but not in the Souris River
Rainbow smelt	*Osmerus mordax*	Found in both the Missouri River basin and Hudson Bay basin
Common carp	*Cyprinus carpio*	Found in Lake Sakakawea and in Hudson Bay basin but not in North Dakota portion of Souris River
River carpsucker	*Carpiodes carpio*	Found in Lake Sakakawea; previous documentation of existence in Souris River questionable (none found since 1976)
Smallmouth buffalo	*Ictiobus bubalus*	Found in Lake Sakakawea but not in Souris River

Although consultations were discontinued in 1984 during the reformulation of the Garrison Diversion project, the U.S.-Canada Consultative Group reestablished the Garrison Joint Technical Committee in September of 1989 to facilitate the consultative process for the reformulated Garrison project. The Joint Technical Committee reported back to the U.S.-Canada Consultative Group with their *Joint Technical Committee Report to the United States-Canada Consultative Group* [Garrison Joint Technical Committee 1990a]. This report, which dealt in detail with the interbasin transfer of water for municipal, rural, and industrial (MR&I) uses, stated on pages 40 and 41:

> "D. MR&I Water/Treatment
>
> "MR&I water systems in North Dakota which have water supply sources and water delivery service areas, both of which are entirely within drainage basins not tributary to Canadian waters, cause no concern for Canada with respect to the pollution of boundary waters or waters flowing across the boundary. Further, systems with service areas or distribution lines in a drainage area tributary to Canadian waters and which are supplied from drainage basins which are also tributary to Canadian waters, will seldom cause concern on the part of Canada. An exception to the latter case would occur if the water supply source was hydrologically connected to surface or groundwater from a drainage basin not tributary to Canadian waters. In view of the above it is apparent that many of the projects which have been and will be proposed for development under the MR&I section of the Garrison Diversion Unit authorization will not require consultation between the United States and Canada.
>
> "It is the opinion of the JTC [Joint Technical Committee] that only those systems which have a water supply source (whether surface or groundwater) in the Missouri River basin and a water distribution in the Hudson Bay drainage basin will require discussions between Canada and the United States under the auspices of those considerations. All such systems must provide for effective treatment of all water which is to be imported for conveyance or delivery in the Hudson Bay drainage basin unless the risk of biota transfer is precluded by virtue of the water being naturally filtered with a minimum of a 50-day seepage period.
>
> "Reclamation and the North Dakota State Water Commission shall assure that information regarding such proposed systems will be supplied to the Inland Waters Directorate, Environment Canada, and to the Manitoba Department of Natural Resources early in the process. In addition, it is suggested that the JTC include this matter as a standing agenda item with respect to all future meetings.
>
> "It is intended that the JTC will analyze and evaluate each such proposal and provide a technical recommendation with respect to the potential for violation of Article IV of the Boundary Waters Treaty. If the JTC determines a project to be of no concern, it shall be considered that the project is of no concern to Canada, unless the United States is advised to the contrary by Canada.
>
> "Consideration was given to certain specific methods of treatment for all Missouri River water to be delivered into the Hudson Bay drainage. The ozonation method appears capable of providing treatment which would be adequate to assure that the violation of the Boundary Waters Treaty would not occur. However, since the effectiveness of this and other treatment processes depends on certain factors such as concentrations, the specific process design, siting, and the provisions for safeguards in case of failure of the system, it would not be prudent to prequalify any specific treatment method.
>
> "It is recognized that the viability and effectiveness of any system or facility for the treatment of Missouri River water for delivery in the Hudson Bay drainage is dependent on system safeguards as well as effective treatment. Provisions must be made to assure that the treatment processes cannot or will not be bypassed, allowing the delivery of untreated Missouri River water into the Hudson Bay drainage. A review of the details of each proposed treatment system by the JTC will be required."

It is suggested that concerned individuals review the Joint Technical Committee report [Garrison Joint Technical Committee 1990b] with its associated biology and engineering appendices to get a further understanding of the biota transfer issues.

In December 1993, the State of North Dakota requested that the Garrison Joint Technical Committee evaluate the transfer of untreated water via pipeline for treatment at an upgraded Minot water treatment plant as part of the NAWS project. The U.S.-Canada Consultative Group appointed a joint Engineering-Biology Task Group to evaluate the NAWS proposal "...and provide a technical recommendation to the Garrison Joint Technical Committee with respect to the potential for violation of Article IV of the Boundary Waters Treaty." This joint Engineering-Biology Task Group submitted its report, *Northwest Area Water Supply, Engineering-Biology Task Group* [Canada/United States Joint Technical Committee, Engineering-Biology Task Group 1994], to the Garrison Joint Technical Committee in April of 1994. The six findings presented in this report are:

"1. A number of pathways exist by which biota transfer has occurred, may be occurring, or could occur even without the completion of the NAWS. These pathways include, but are not limited to, the following: Approved transfer or introduction by fisheries management agencies, unauthorized or accidental introduction, accidental or deliberate introductions from bait buckets and live wells, or from boat bilges or boat hulls. While extensive efforts are being made to control these pathways, a residual probability remains that biota transfer may/could occur through one or more pathways;

"2. Only the East System of the NAWS Proposal is of concern relative to biota transfer to the Hudson Bay drainage. The Parshall and West Systems would be served by water treated to drinking water standards within the Missouri River drainage;

"3. The East System of the NAWS project, whereby Missouri River water would be distributed in the Hudson Bay drainage, has the potential to transfer Missouri drainage biota to the Hudson Bay drainage. The most acceptable method of fully overcoming this would be to treat the water to acceptable drinking water standards prior to its transport into the Hudson Bay drainage;

"4. The Task Group found that all pipeline options had a relatively low risk of transferring biota to the Hudson Bay drainage if they included chloramination at the source of the pipeline to control slime growth. As shown in Table S-1, the relative risk of biota transfer decreased with the addition of safeguards. The cost of options increased with the magnitude of the safeguards.

"5. Because of the consequences of a pipeline failure, operation, maintenance, and replacement must ensure the integrity of the pipeline for its entire operational life;

Table S-1 Comparison of Options

Biota Transfer Risk Reduction Option (RRO)	Risk	Incremental Cost[1] ($1,000's)	Total Cost ($1,000's)	Annual O&M Cost
OPTION O: Minot treatment only	MEDIUM	$ 0	$ 10,850	$ 975,000
OPTION 1: Minot treatment, chloramination	LOW	$ 650	$ 11,500	$ 1,020,000
OPTION 2: Minot treatment, chloramination, blow off containment structures, extra signing, motor operated mainline valves, welded pipe, WTP [Water Treatment Plant] containment, and WTP flood control	VERY LOW	$ 4,700	$ 15,550	$ 1,120,000
OPTION 3: Option 2 + rupture containment system	EXTREMELY LOW	$ 10,550	$ 21,400	$ 1,150,000
OPTION 4: Phased Development[2]	VIRTUALLY NONE[3]	$ 5,700	$ 16,550	$ 1,380,000
OPTION 5: Full supply treated at source	VIRTUALLY NONE[3]	$ 10,850	$ 21,700	$ 1,005,000

[1] Incremental cost is the cost of the risk reduction option minus the cost of treatment at Minot alone ($10.85 million, Option O in table).

[2] Phased development combines a 20.5 MGD treatment plant at source and 8 MGD treatment at Minot. Treated water is mixed in Minot WTP for treatment, or is "decontaminated," or is disposed of in the Missouri drainage.

[3] Provided that treatment is adequate to address biota transfer concerns.

"The likelihood of failure of the East System could be reduced through the adoption of the following measures:

- identify one agency responsible for operating and maintaining the entire system;
- all raw water captured in containment structures, which would not meet the 50-day seepage travel time criteria, is either transferred into the Minot WTP for treatment, or is "decontaminated," or is disposed of in the Missouri drainage;
- Minot WTP sludge is handled in such a manner that incidental or accidental discharge to the Souris River is not possible;
- all structural components are monitored, maintained, and repaired as called for in the original designs;
- disinfectant residual is monitored and maintained to the original design standard, and other water quality standards will be monitored.

"6. If chloramination within the Missouri River drainage proves to be effective in addressing biota transfer concerns, standard engineering practices for construction, maintenance, and replacement could be followed."

The Consultative Group considered and accepted the findings of the Engineering Biology Task Group during a joint meeting of the Joint Technical Committee and the Consultative Group on September 23, 1994. The Consultative Group did, however, conclude that a study of the effectiveness of the proposed chloramination process be undertaken.

Based on this conclusion, the State Water Commission initiated the NAWS Chloramine Challenge Study in the fall of 1994. The purpose of this disinfection study was to investigate the effectiveness of chloramination for disinfection and pre-treatment of Missouri River water. Raw water would be disinfected prior to its transport into the Hudson Bay watershed so that it meets the disinfection requirements of 3-log and 4-log inactivation of Giardia and viruses, respectively. With concurrence of the Garrison Joint Technical Committee, ozonation was added to the challenge study in the spring of 1995.

Montgomery Watson engineers conducted the challenge study and developed the experimental protocols for microbial inactivation using chlorine/chloramine and ozone. The chlorine/chloramine protocols included both *Giardia* and MS2 Bacteriophage inactivation experiments. The ozone protocols were developed for *Giardia* inactivation. Following are excerpts from the summary (Section 5) of the *Chloramine Challenge Study* [Houston Engineering et al. 1995b].

> "This study demonstrated that chloramine could be employed for disinfection of Lake Audubon water. Four logs of MS2 virus were inactivated in less than 30 seconds of free chlorine contact time with a residual between 3.5 mg/L and 4.0 mg/L. However, 5 minutes of free chlorine contact time are recommended as a margin of safety. *Giardia* inactivation experiments showed that with a dose of 4.5 mg/L and 5 minutes of free chlorine contact time followed by ammonia addition to form chloramine, greater than 3 logs of inactivation were achieved in less than 180 minutes. Under these conditions, the contact time for inactivation is approximately one half of the residence time in the pipeline to the divide (5.9 hours) corresponding to the peak daily flow of 28 mgd....

> "This study also demonstrated that ozone could be employed for disinfection of Lake Audubon water. Greater than 3 logs of *Giardia* inactivation were achieved in approximately 4 minutes at doses greater than or equal to 0.3 mg/L ozone at 4°C. Inactivation continued to occur despite the consumption of ozone residual. Although inactivation of viruses by ozone was not investigated at bench-scale, viruses are more sensitive to ozone than protozoan cysts; therefore, virus inactivation requirements would be met if 3 logs of *Giardia* inactivation is achieved by ozone treatment."

Details of the disinfection study are contained in the *Northwest Area Water Supply Project, Chloramine Challenge Study, Final Report* [Houston Engineering et al. 1995b]. This study report was subsequently presented to the Garrison Joint Technical Committee in January 1996.

3.6.3 Pre-Final Design Plan

Based on conclusions and recommendations of the U.S.-Canada Consultative Group and the Garrison Joint Technical Committee, the following design elements are incorporated into the design of Alternative A and the Preferred Alternative of the NAWS project to address the specific issues of biota transfer.

- Raw water would undergo pre-treatment near the intake or Max booster pump station with either ozone or chlorine/chloramine. A chloramine residual would be maintained in the pipeline for biofilm control.

- The water pipeline between the continental divide and the Minot water treatment plant would be constructed of steel or ductile iron with a cement mortar lining and a uniform exterior coating to reduce corrosion. The entire raw water pipeline would be provided with active cathodic protection to reduce corrosion.

- The pipeline would be overlain with a minimum of 7.5 feet of fill to reduce the possibility of freezing.

- Water containment vaults would be located at each air release and vacuum valve located on the pipeline within the Hudson Bay watershed.

- A computerized supervisory control and data acquisition system would be installed to monitor the entire operation of the raw water pipeline. The portion of the raw water pipeline within the Hudson Bay watershed would be equipped with special warning and pressure monitoring devices.

- Standby power units would be located at the Lake Audubon/Sakakawea intake plant, the Max pumping station, and the Minot treatment plant to ensure continuous monitoring in case of a temporary or total power outage.

- The pre-treated water would be softened and filtered at the upgraded Minot water treatment plant. Chloramine would be used for a distribution system disinfectant residual.

- The sludge handling system at the Minot water treatment plant would be upgraded to further reduce the potential for biota transfer. The sludge is currently disposed of in a Class A landfill which includes containment berms, lined landfill cells, and a leachate collection system.

The above elements have been incorporated into the pre-final design.

3.6.4 State Commitments During Final Design

In order to ensure that the issues associated with biota transfer are addressed during the final design of either Alternative A or the Preferred Alternative, construction and operation of the pre-treated water delivery system, the State of North Dakota has committed to the following:

- Water quality monitoring of raw water sources will be implemented to determine how seasonal changes in water quality may affect disinfection strategies.
- A long-term water monitoring plan will be developed to assess the effectiveness of pre-treatment in meeting the disinfection requirements of 3-log and 4-log inactivation of *Giardia* and viruses, respectively.
- Final design plans and construction specifications for the pre-treatment and delivery systems will be provided to the Garrison Joint Technical Committee prior to the awarding of their respective construction contracts.
- A long-term operation, maintenance, and replacement plan will be provided to the Garrison Joint Technical Committee for review, prior to the system becoming operational.
- Sludge resulting from the filter backwash and softening clarification processes at the Minot Water Treatment Plant will be either treated to inactivate disinfectant resistant pathogens or transported for disposal at an appropriate disposal facility. Disposal of sludge within the Minot municipal waste landfill (RCRA subtitle D landfill) is acceptable provided the sludge is placed within lined cells, covered daily with soil, and the leachate from the landfill is not discharged into a waterway within the Hudson Bay basin. Disposing of sludge leachate in the city sewage treatment system will not be allowed. Any sludge from the leachate collection system will also be placed in the lined cell at the landfill. Landfill disposal within the Missouri River basin will be explored as an alternative. The annual monitoring, operational and maintenance report to the JTC will include information to verify compliance with this commitment.
- An emergency response plan, with special emphasis on potential biota transfer issues, will be provided to the Garrison Joint Technical Committee, prior to the system becoming operational.
- The pre-treated water reservoir and the pressure reducing valve (PRV) vault within the Hudson bay basin incorporates isolation valves. Three additional automated isolation valves will be incorporated in the design of the pipeline within the Hudson Bay basin to

reduce volumes of water released in the event of a pipeline failure. These will be located approximately at pipeline stations 2377+60, 2480+40, and 2527+20.

- The State of North Dakota, through the State Water Commission, will provide an annual monitoring, operation, and maintenance report to the Garrison Joint Technical Committee.

- The State of North Dakota, through the State Water Commission, will assume ultimate responsibility for the operation, maintenance, and replacement of the pre-treatment and delivery system.

- The State of North Dakota, through the State Water Commission, will implement the recommendations of the Biota Transfer Control Measures Report (Houston Engineering et al, 1998) and the Biota Transfer Control Measures Report Update (Houston Engineering and Montgomery Watson, 2001), and refinements thereof during the detailed design of the facilities, and during startup of operations. These reports consolidate the results of studies, findings, process recommendations and management plans for biota transfer control.

- The State of North Dakota, through the State Health Department, will assume responsibility for Safe Drinking Water Act compliance monitoring for the raw water disinfection system.

- The Garrison Joint Technical Committee or its representatives will be permitted to inspect the system and examine the records at any time.

- The State of North Dakota, State Water Commission, and the NAWS Advisory Committee will continue to provide project updates to the U.S.-Canada Consultative Group as the project moves into final design phase.

The commitment to reduce the risk associated with the transfer of living organisms from one watershed to another is not only made because of Canadian concerns, but because it is a good water management practice. The State of North Dakota, through the State Water Commission, is committed to reducing the risk of transferring potentially harmful biota between watersheds both within the state and across international waters.

3.6.5 Environmental Consequences

Alternative A - Integrated system

The risk of interbasin biota transfer due to the project would be very low with the pre-treatment of raw water with ozone, chlorine/chloramine, or chloramine, and with design safeguards described in Section 3.6.3.

Alternative B - Upgrade of Existing Systems

Water would not be transferred from the Missouri River basin to the Hudson River basin, or vice versa, in this alternative, so no risk of biota transfer would occur as a result of Alternative B.

Preferred Alternative - Combination of Alternatives A and B

The risk of interbasin biota transfer due to the project would be very low with the pre-treatment of raw water with ozone, chlorine/chloramine, or chloramine, and with design safeguards described in Sections 3.6.3.

No Action Alternative

Water would not be transferred from the Missouri River basin to the Hudson River basin, or the reverse, in this alternative, so there would be no risk of biota transfer due to the project.

3.7 Threatened and Endangered Species

3.7.1 Affected Environment

The Federal Endangered Species Act, authorized by Congress in 1973, declared that species of "fish, wildlife, and plants are of aesthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people." The purpose of this Endangered Species Act is conservation of endangered species, their ecosystems and their critical habitat. This section has been prepared in compliance with Section 7c of the Endangered Species Act.

The U.S. Fish and Wildlife Service [1995] has prepared a list of federally listed endangered, threatened, and candidate species that occur in North Dakota. Table 12 lists the species known to occur, or which could possibly occur, in the eight-county NAWS project area.

The North Dakota Natural Heritage database, maintained by the North Dakota Parks and Recreation Department, has records of occurrences of rare natural communities, vascular plants, and animals within the state. Although these species are not protected by specific state statute, agencies are encouraged to avoid adversely impacting these species when planning or constructing projects. These species are also included in the following sections.

Table 12. County occurrences of federally threatened or endangered species within the NAWS project area.

Species	Status	Bott.	Burke	Divide	McLean	Moun.	Ren.	Ward	Will.
Least tern	E				X	X			X
Peregrine falcon	E	X	X	X	X	X	X	X	X
Whooping crane	E	X	X	X	X	X	X	X	X
Black-footed ferret	E								X
Gray wolf	E	X	X	X		X	X	X	X
Pallid sturgeon	E				X	X			X
Bald eagle	T	X	X	X	X	X	X	X	X
Piping plover	T		X	X	X	X	X	X	X

E - Endangered
T - Threatened
X - Species occurrence

3.7.2 Environmental Consequences

Alternative A — Integrated System

Plant species

North Dakota's only federally listed plant species is the western prairie fringed orchid (*Platanthera praeclara*) which inhabits moist tall-grass prairies and sedge meadows. No occurrences of this threatened species are documented in the eight-county project area.

A rare North Dakota plant species, the greenthread (*Thelesperma subnudum* var. *marginatum*), is documented in the North Dakota Natural Heritage database as occurring near Lake Zahl National

Wildlife Refuge, which is within the corridor of Segment 12 of the proposed pipeline route. A field survey may need to be conducted to determine if greenthread is present and would be impacted by construction of the pipeline. The Impact Mitigation Assessment team would review the final location of the pipeline and determine if a survey is needed. However, since State Highway 50 runs through this section, impacts to this species are unlikely unless the occurrence is in or near the existing rights-of-way.

Invertebrate species

No federally threatened or endangered invertebrate species are known to occur within the NAWS project area.

The North Dakota Natural Heritage database shows the occurrence of the Iowa skipper (*Atrytone arogos iowa*), a state rare butterfly species near Burlington, adjacent to Segment 13 of the proposed pipeline. This species is globally rare and has questionable status in North Dakota. Its habitat in North Dakota is southwestern valley walls of the Souris and Des Lacs Rivers. The Impact Mitigation Assessment team would review the final location of the pipeline and determine whether a butterfly survey is needed. U.S. Highway 2 runs through this section and has a wide right-of-way, which should be sufficient to accommodate pipeline construction.

Fish species

Pallid sturgeon (*Scaphirhynchus albus*) is North Dakota's only federally listed fish species. The endangered pallid sturgeon lives near the bottom of large, fast-moving rivers. In North Dakota, they are present in the Missouri and lower Yellowstone Rivers. However, locations of all proposed intake structures are located in the reservoir and therefore, would not likely impact pallid sturgeon populations.

Bird species

The interior least tern (*Sterna antillarum*) is a federally listed bird species which utilizes sparsely vegetated sandbars on the Missouri and Yellowstone Rivers. Since the intake structure and pumping facilities would not be located on the free-flowing portion of the Missouri River, direct impacts to least terns would not occur. The withdrawal of water from the Missouri River system would not change water levels measurably and would not affect this species.

Peregrine falcons (*Falco peregrinus*) and bald eagles (*Haliaeetus leucocephalus*) are known to migrate through North Dakota, including the project area, and bald eagles winter in the state along the Missouri River. Peregrine falcons use a variety of habitats, although cliffs are preferred for nesting. Construction of project facilities within the eight-county area would not affect habitat used by migrating falcons nor bald eagles. Bald eagles prefer forested habitats near bodies of water and concentrate near open water habitat below Garrison Dam in the winter. The Garrison Dam is outside the project area and none of the project features are expected to impact bald eagles.

Shallow wetlands characterized by cattails, bulrushes, and sedges provide habitat for the federally listed whooping crane (*Grus americana*) during migration. The North Dakota Natural Heritage database lists a migrating whooping crane observation in Burke County near Columbus, about one mile north of State Highway 5. It is unlikely this wetland would be affected by construction since it is one mile north of the highway right-of-way. Whooping cranes usually follow established flyways during migration but do not utilize traditional roosting sites in the state. It is highly unlikely that whooping cranes would be affected during construction, and therefore, they would not be affected by the project.

The federally listed piping plover utilizes barren sand and gravel shores of rivers and lakes. The North Dakota Natural Heritage database shows an occurrence of saline wetland in Section 6, T159N-R86W, and an occurrence of piping plovers in this Section 6 and the nearby Section 4, T159N-R86W. Both of these areas are found along Segment 14 (Berthold to Parshall) of the proposed pipeline. If the pipeline were constructed west and north of the existing road, contact with the sensitive ecological communities and piping plovers would be minimized. If these conditions are followed, no adverse impacts to piping plovers would be expected.

Mammalian species

Two mammals, the black-footed ferret (*Mustela nigripes*) and the gray wolf (*Canis lupus*), are listed as federally endangered species occurring in North Dakota. The black-footed ferret inhabits short-grass prairie and is found in close proximity to prairie dogs towns. Within the project area, Williams County has a historical occurrence of the black-footed ferret. However, no active prairie dog towns are found in the project area, including Williams County, and no black-footed ferret populations are known to exist within the State of North Dakota.

The gray wolf occasionally appears in North Dakota, preferring mainly forested areas with few people and roads. They have been known to be occasional visitors to seven of the eight counties within the project area. It is highly unlikely that this project would impact the gray wolf or its habitat.

If any threatened or endangered species are encountered during construction, all ground-disturbing activities in the proximate area would be stopped immediately until Reclamation consults with the U.S. Fish and Wildlife Service to determine appropriate steps to avoid any effects to the species. Cessation of construction in the area would occur in this event.

Alternative B — Upgrade of Existing Systems

Impacts to federally threatened and endangered species would be limited to loss of habitat from permanent facilities that might displace habitat a listed species might use. The only federally listed species of concern would be the piping plover. Placement of treatment plants, pipelines, and brine ponds in areas that avoid saline lakes would ensure there are no impacts to piping plovers or their habitat. Also, construction of the Burlington pond would bypass southwestern valley walls of the Souris River to avoid possible impacts to the Iowa skipper butterfly, which could be of state concern. No adverse impacts to threatened or endangered species are expected.

Preferred Alternative — Combination of Alternatives A and B

Impacts to federally threatened or endangered species by implementation of the Preferred Alternative would be similar to those listed above for Alternative A, with two exceptions. Since Segments 11, 12, and 14 of the pipeline would not be constructed, potential impacts to saline lakes in Section 6, T153N-R86W, and piping plovers in Sections 4 and 6, T153N-R86W would not occur. Placement of treatment plants and brine ponds in Wildrose, Grenora, and Parshall would avoid saline lakes and ensure no impacts to piping plover habitat occurs. No adverse impacts to threatened or endangered species are expected.

No Action Alternative

There would be no impacts to threatened or endangered species under the No Action Alternative.

3.8 Wetlands

3.8.1 Affected Environment

Wetlands are defined by the U.S. Army Corps of Engineers for regulatory purposes as "an area that has a predominance of hydric soils and that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances does support a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions."

Wetland classification in the prairie pothole region is based on water permanency and plant cover. Cowardin et. al. [1979] uses several classes of water regimes to describe conditions of nontidal wetlands. The four most often used water regimes in North Dakota are temporary, seasonal, semipermanent, and permanent. Wetlands are grouped according to this classification for assessing impacts in this environmental assessment.

Temporary Wetlands

Wetlands with temporary regimes have surface water present for brief periods during the growing season, but the water table usually lies below the soil surface for most of the season. They may remain wet for several days after heavy precipitation.

Fine-textured grasses, sedges, rushes, and forbs are found in temporary wetlands. The salinity of the soil and water can vary from one wetland to another and may cause species composition to differ. Primary plant species include fowl bluegrass (*Poa palustris*), northern reedgrass (*Calamagrostis sticta*), prairie cordgrass (*Spartina pectinata*), slender sedge, woolly sedge, and Baltic rush (*Juncus balticus*). Narrow-leaf dock (*Rumex stenophyllus*), western dock (*Rumex occidentalis*), silverweed (*Potentilla anserina*), American germander (*Teucrium canadense*), and western ironweed (*Vernonia baldwinii*) are commonly occurring forb species [Stewart 1975].

Seasonal Wetlands

Wetlands with seasonal water regimes have surface water present for extended periods, especially early in the growing season, but is absent by the end of the season in most years. They will often remain wet for several weeks after heavy precipitation.

The peripheral vegetative zone is composed of fine-textured grasses, rushes, and sedges while the central, deeper water area often includes coarser grasses, sedges, and grass-like plants [Stewart 1975]. Vegetation of the central zone is primarily emergent species such as giant burreed (*Sparganium eurycarpum*), American sloughgrass (*Beckmannia syzigachne*), common spikerush (*Eleocharis sp.*), sprangletop (*Scolochloa festucacea*), narrowleaf waterplantain (*Alisma gramineum*), marsh smartweed (*Polygonum sp.*), and water parsnip (*Sium suave*) [Stewart 1975]. Open-water areas often occur in deeper parts of this central zone. Vegetation is commonly in the form of submerged aquatic plants such as variable pondweed (*Potamogeton gramineus*), and common water starwort (*Callitriche spp.*).

Semipermanent Wetlands

Wetlands with semipermanently flooded water regimes have surface water that persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface. These wetlands will become dry during drought cycles.

These wetlands are characterized by the vegetation of the central deep-water zone. Primary emergent species are cattails (*Typha spp.*) and bulrushes including hardstem bulrush (*Scirpus acutus*), river bulrush (*Scirpus fluviatilis*), and slender bulrush (*Scirpus heterochaetus*) [Stewart 1975]. Scattered open-water areas are frequently inhabited by submerged aquatic vegetation including sago pondweed (*Potamogeton pectinatus*), horned pondweed (*Zannichellia palustris*), clasping leaf pondweed (*Potamogeton richardsonii*), widgeon grass (*Ruppia maritima*), common bladderwort (*Utricularia vulgaris*), coontail (*Ceratophyllum demersum*), and common watermilfoil (*Myriophyllum verticillatum*) [Stewart 1975].

Permanent Wetlands

Wetlands with permanently flooded water regimes have water that covers the land surface throughout the year in all years. Several successive years of below-normal precipitation and runoff may cause these wetlands to dry up.

Permanent wetlands are often identified by a large, permanent open-water area which is centrally located and surrounded by concentric zones of vegetation common to semipermanent, seasonal, and temporarily flooded wetlands, as described earlier. Vegetation of the central open water area includes sheathed pondweed (*Potamogeton vaginatus*) and widgeon grass, although some deeper portions of the basin are often barren of submerged vegetation [Stewart 1975].

3.8.2 Environmental Consequences

Alternative A — Integrated System

Table 13 provides the acres of wetlands which would be encountered along the pipeline corridor if the pipeline were built adjacent to the road. The potential pipeline route (110 feet wide) was placed on digitized national wetland inventory maps, and acreage figures for encountered wetlands were calculated using a computerized geographic information system (PC ARC/INFO). These acreage figures are considered to be high estimates because many of these wetlands would be avoided in the final design and construction. Placement of permanent facilities would also avoid wetlands, so wetland impacts from permanent facilities was assumed to be nonexistent.

Most wetlands would be avoided during pipeline layout and construction. However, some wetlands would be temporarily impacted during construction, and some could be permanently lost. Seasonal, semipermanent, and permanent wetlands would be avoided whenever possible. If a wetland could not be avoided, pipelines would be placed on road shoulders through wetlands, with the trench bottom above the impermeable layer where possible. Backfill would be placed in trenches to restore the impermeable layer where necessary. Diaphragms or cutoff collars would be used where soils and engineering design evaluations indicate they are needed to prevent drainage of any wetland. Where practical, construction through wetlands would occur after July 15 to minimize disruption to nesting waterfowl and other wildlife.

Table 13. Acreage of wetlands potentially impacted by construction of NAWS pipeline (Alternative A).

Segment Number	Acres Impacted				
	Permanent	Semipermanent	Seasonal	Temporary	TOTAL
1	0.0	18.9	20.1	4.6	43.6
2	0.0	7.9	5.2	6.9	20.0
3	0.0	10.8	8.4	10.5	29.7
4	0.0	1.2	0.3	3.9	5.4
5	0.0	0.2	1.1	1.0	2.3
6	0.0	1.3	5.2	1.4	7.9
7	0.0	0.5	2.3	0.3	3.1
8	0.0	1.2	6.4	1.0	8.6
9	0.0	13.2	13.5	3.3	30.0
10	0.0	9.5	19.4	22.5	51.4
11	0.0	10.6	4.4	1.3	16.3
12	0.0	7.1	2.4	1.3	10.8
13	0.0	0.0	2.3	0.3	2.6
14	0.0	17.9	21.1	12.1	51.1
15	0.0	3.1	10.3	1.5	14.9
TOTAL	**0.0**	**103.4**	**122.4**	**71.9**	**297.7**

Temporary wetlands would be difficult to avoid. While reclamation procedures would ensure that contours remain the same as before construction, temporary wetlands less than one acre in size might be difficult to restore because of their shallow nature. If for some reason an existing wetland could not be reconstructed in its current location, an equal number of wetlands (of equal size or greater) would be created or restored under the Garrison Diversion Unit's mitigation plan.

The wetland mitigation ledger would be used in consultation with the U.S. Fish and Wildlife Service.

Temporary impacts to invertebrates in wetlands could occur if a line break happened in close proximity to a wetland. Water treated with the chloramine disinfectant could enter the wetland and kill invertebrates. Once the line break is secured, invertebrates would likely recolonize the wetland and populations would eventually return to normal.

Alternative B — Upgrade of Existing Systems

Since wetlands would be avoided when siting for construction of reverse osmosis brine ponds or in locating new water treatment plants, no impacts to wetlands from permanent facilities are anticipated.

Construction of the pipeline portion of this alternative may cross wetlands, but impacts are expected to be minimal and would be avoided wherever practical. Where they are not avoidable, mitigation procedures described in Alternative A above would be followed.

Preferred Alternative — Combination of Alternatives A and B

Wetland impacts in this alternative would be similar to those of Alternative A, with fewer acres impacted because fewer miles of pipeline would be built. Overall acreage impacted would be reduced to a possible 220 acres, with 67.8 acres being classified as semipermanent wetlands, 94.5 acres as seasonal, and 57.2 acres as temporary.

No Action Alternative

The No Action Alternative would have no effect on wetlands.

3.9 Historic Properties

3.9.1 Affected Environment

The proposed NAWS project is divided into 15 segments that would be constructed over a period of several years. Only Segment 1, which extends from Lake Audubon/Sakakawea to Minot, is scheduled for construction in the near future. Most segments are still in the preliminary planning stages, and only estimated center lines are presently available for environmental analysis. A two-mile wide corridor for each segment was used for collection of baseline information on historic properties and to estimate impacts on these resources. This corridor represents the best route estimate, but additional research would be required when designs are finalized.

This section of the environmental assessment provides an overview of the prehistory and history of the area, summarizes the known historic properties in each proposed segment and compares the impacts of the four pipeline alternatives on historic properties. The environmental commitments section describes the process that would be followed to avoid or to mitigate historic properties. The density and types of historic properties in the counties that the NAWS project proposes to serve vary to some degree. The level of research on these resources is also variable. The resources and previous investigations along each segment are summarized.

As part of the environmental assessment of the NAWS project for the Bureau of Reclamation, Powers Elevation Co., Inc. was contracted by American Engineering, P.C. to complete a literature review for a two-mile wide corridor for each of the fifteen pipeline segments. This review was conducted at the offices of the State Historical Society of North Dakota (SHSND) in Bismarck, in August and September of 1996. The records consulted were the site index files, site forms, manuscript index files, and manuscripts on file in the Archives and Archeology and Historic Preservation Divisions. The results of the file search appear in a report entitled, "Northwest Area Water Supply Project, Bottineau, Burke, Divide, McLean, Mountrail, Renville, Ward, and Williams Counties, North Dakota: A Class I Cultural Resources Inventory." The following indented paragraphs are quoted from that report [Olson 1998].

> The prehistoric portion of the following cultural overview is largely drawn from North Dakota Comprehensive Plan for Historic Preservation: Archeological Component [SHSND 1990]. The Comprehensive Plan divides the state into 13 study units, two of which, the Garrison and the Souris River Study Units, are crossed by the project. These study units provide the spatial framework for the overview.
>
> At the most general level, the Comprehensive Plan divides the prehistory of North Dakota into five cultural traditions: Paleoindian, Plains Archaic, Plains Woodland, Plains Village, and Equestrian Nomadic. Each cultural tradition is further subdivided into complexes, but the traditions as a whole can be characterized by particular subsistence and settlement patterns, by the presence or absence of ceramics, and by the presence or absence of the horse. With some overlap, the five traditions also represent a chronological sequence covering the last 11,000 years of North Dakota prehistory. Added to this sequence is Euroamerican history beginning in 1738 with Verendrye's expedition into North Dakota.

PALEOINDIAN TRADITION

> The earliest documented evidence of human occupation in the study area is during the Paleoindian tradition, which began 11,000-12,000 B.P. and ended roughly 7500 B.P. The tradition is generally associated with the exploitation of now-extinct Pleistocene megafauna and named complexes within the tradition include, in decreasing age, Clovis, Goshen, Folsom, Hell Gap/Agate Basin, Cody, Plainview, and Parallel Oblique-Flaked [Gregg 1985]. The earliest Paleoindian peoples hunted mammoth and camel with Clovis and Goshen projectile points. With the extinction of these species in North America, sites with Folsom and later points indicate that a bison species larger than the modern form was hunted. However, Schneider [1982] points out that there are no "documented associations of extinct fauna with Paleoindian artifacts in North

Dakota." Whether this is simply a product of the small number of Paleoindian sites that have been located and investigated or is indicative of a broader economic base on the Northern Plains is an unresolved issue.

At the beginning of Paleoindian times, ca. 12,000 B.P., the prevailing climate of North Dakota was characterized by cool, moist conditions that followed the retreat of the Pleistocene continental glaciers. Paleoclimatic modeling indicates that the atmospheric circulation through the region was markedly different from that at present due to the effects of a still-substantial ice sheet in the Hudson Bay region of Canada. Centered over this ice sheet was a large, persistent low pressure system that brought prevailing, cool easterlies into the Dakotas during the summer and perhaps moist air from the eastern seaboard as well [Thompson et al. 1993]. Spruce-aspen parklands covered all but the southwestern quadrant of the state [Gregg 1985]. The southwestern quadrant was grassland suggesting that the modern precipitation gradient developed at an early date. It is within this southwestern area, particularly the Garrison Study Unit, that the majority of Paleoindian projectile points have been found. Schneider [1982] hypothesizes that the point distribution reflects the paleoecology of the state: compared with the spruce-aspen forests, the southwestern grasslands would have supported larger herds of the game animals that were the principal quarry of Paleoindian hunters.

By 9000 B.P., atmospheric circulation had shifted to prevailing westerlies [Thompson et al. 1993], bringing drier climatic conditions. The prairie expanded to modern limits, displacing the spruce-aspen parklands northward. Root et al. [1986] report that sedimentation rates along Spring Creek in Dunn County increased sharply sometime after ca. 9500 B.P., and this is interpreted as marking a shift to more arid conditions. Concomitant increases in temperature and decreases in moisture likely reduced the carrying capacity of the prairie with consequent decreases in the large game resources available to prehistoric peoples. Probably related to this is a change in projectile point styles.

Paleoindian points after 9000 B.P. are grouped together in a catch-all group, the Parallel-Oblique Flaked Complex (POFC). In contrast to earlier complexes, the individual point styles comprising the Parallel-Oblique Flaked Complex have more restricted distributions suggesting that Parallel-Oblique Flaked Complex peoples were less widely traveled than earlier groups and probably exploited smaller territories, perhaps of necessity.

Occurrences of Paleoindian materials are sporadic [Schneider 1982; Beckes and Keyser 1983]. The majority of the artifacts from this period in the study area are collections made by Hecker in 1938 that are now curated at the State Historical Society of North Dakota Museum Division. Whether these were isolated surface finds or derived from sites is unknown; the locations where they were found are poorly specified. The major Paleoindian site in the western part of the state is the Moe Site (32MN101) which is in the Garrison Study Unit near New Town, North Dakota, well south of all project reaches. More pertinent to the NAWS project, the SHSND [1990] comments: "... there is no official record of Paleo-Indian sites from the [Souris River] Study Unit even though this area may be second only to the Garrison Study Unit in occurrence of Paleo-Indian sites considering Hecker's [1938] notations of Paleo point finds."

PLAINS ARCHAIC TRADITION

The Plains Archaic tradition spans a time period between roughly 7500 B.P. and 2000 B.P. and is divided into Early, Middle, and Late components. Compared to the preceding Paleoindian tradition, subsistence practices during Plains Archaic times are thought to be more diversified, in terms of the range of resources utilized, and more focused, with smaller geographical ranges for individual groups. The animals and plants exploited were essentially those represented by modern forms. Bison herds were the primary source of meat and were the mainstay of the subsistence systems. Reconstructions suggest that Archaic peoples followed seasonal rounds that included winter base camps in the deeper, heavily wooded drainages such as the Missouri, Little Missouri, Yellowstone, and Souris Rivers. In the spring and throughout the summer, people moved from these sheltered locations onto the open grasslands, with group movements adjusted to bison distribution and the seasonal emergence of various edible plants. Movement back towards wintering areas began in the fall, culminating in major efforts to obtain a reserve of dried meat, berries, and bone grease for winter provisions..The Souris River valley was probably one such refuge. Early spring was the time of greatest privation. Winter stores were depleted, plant resources were still locked in frozen or snow-covered ground, and the meat in game animals was so lean that it did not supply sufficient nutritionally necessary fat.

The beginning of the Plains Archaic tradition correlates with the onset of a xeric climatic episode known as the Altithermal. The episode nominally encompasses a period between roughly 7500 B.P. and 5500 B.P. The term "Altithermal" derives from the work of Antevs [1955], but his classic description of the episode is no longer tenable. Rather than occurring synchronously across the western half of North America, the spatial and temporal boundaries of the climatic episode are transgressive. Moreover, accumulating evidence indicates that more than one xeric episode is represented. Benedict [1979], for example, has postulated two distinct droughts within the period. After 5500 B.P., the Middle and Late Plains Archaic occupations saw alternating episodes of wetter and drier conditions, but the latter were less severe and less prolonged than during the peak(s) of the Altithermal.

Early Archaic projectile points are represented by Logan/Mummy Creek, Hawken [Frison et al. 1976], and Oxbow [Nero and McCorquodale 1958; Wettlaufer and Meyer-Oakes 1960] complexes. The type sites for these point styles date to within the Altithermal, but in western North Dakota the Logan/Mummy Creek occupations seem to have occurred at the end of or after the Altithermal [Kuehn 1984; Peterson and Peterson 1994]. A plausible speculation is that Early Archaic peoples expanded from Altithermal refuges, such as the Black Hills (a Hawken point locus) or the parklands in Saskatchewan (an Oxbow point locus), onto the short grass prairie as Altithermal conditions ameliorated.

Middle Archaic occupations are predominantly represented by McKean sites, all of which have basally indented points. Three successive complexes have been proposed based upon an evolution from lanceolate to stemmed to side-notched point forms. These complexes are, respectively: McKean Lanceolate (ca. 4200-3800 B.P.), Duncan (ca. 3800-3400 B.P.), and Hanna (ca. 3400-3000 B.P.). The type sites for all three complexes are in Wyoming and appear to be older there than typologically equivalent point styles in North Dakota. In western North Dakota, McKean Lanceolate sites occur less frequently than either the preceding Oxbow sites or the succeeding Duncan and Hanna sites.

Reeves [1970] has postulated that the McKean Complex sites were the beginning of what he describes as the TUNAXA "cultural tradition" with subsequent "phases," i.e., complexes, identified as Pelican Lake and Avonlea. Pelican Lake is a Late Plains Archaic corner notched point form dating to the period ca. 3,300-2,000 B.P. The type site for Pelican Lake is in Saskatchewan on Long Creek, a drainage that flows north of Reach 11.

PLAINS WOODLAND TRADITION

The Plains Woodland tradition is dated to ca. 1000-2000 B.P. and is characterized by the presence of burial mounds and appearance of ceramics (two traits that suggest Eastern Woodlands influences) and by the bow and arrow [Caldwell and Henning 1978]. Trade networks resulted in a wide dispersal of Knife River Flint, notably to the east and southeast into the Hopewell Interaction Sphere.

The most common Woodland complex identified statewide, and the one that may responsible for many of the stone circle (tipi ring) sites in the project area, is the Besant Complex [Reeves 1983]. The complex first appears about 2000 B.P. and dominates the archaeological record of central and western North Dakota until about 900 B.P. Besant peoples appear to have had a subsistence system with an unusually heavy emphasis upon bison hunting. That they were exceptionally adept at bison procurement is evidenced at the Ruby site where the remains of drive lines and sophisticated wood corrals are preserved [Frison 1978].

The typical Besant point is a large spear or at that point with a broad blade and rounded side or corner notches. Towards the end of the Plains Woodland tradition, reductions in the overall size of projectile points and a hefting width of less than 11 mm are thought to mark the introduction of the bow and arrow [Knight and Keyser 1983]. The bow and arrow, however, did not either completely or rapidly supplant spears and atlatls. Rather, both types of hunting equipment were used, each probably dominant in those circumstances where it was most effective.

PLAINS VILLAGE TRADITION

The Plains Village tradition emerged around 1100 B.P. and continued into historic times where it is represented by the Mandan, Hidatsa, and Arikara cultures. The Plains Village subsistence system along the Middle Missouri River was based upon a combination of floodplains horticulture and bison hunting [Lehmer 1971]. Archaeological, historic, and ethnographic records indicate that semi-subterranean earth lodges were occupied during the summer months on the higher terraces overlooking the Missouri and Heart Rivers. Corn, squash, beans, and sunflowers were cultivated in garden plots in the rich floodplain soil. In late summer and fall months, the produce from these plots was collected, dried in racks or on the substantial roofs of the lodges, and placed in storage pits for winter consumption. During the winter, temporary villages were built on the wooded floodplains, both to escape harsh winter winds and to be nearer firewood. In addition to gardening, bison hunting on the open prairie was another important activity during the summer months.

No village sites have been reported from within the project area, but Floodman and Friedman [1986] report a Plains Village component from one site along the Souris River. Hecker [1938] describes a dense cluster of sites along Long Creek. In addition to lithic debitage, the associated cultural material is described as including abundant bone and ceramic fragments. This type of assemblage is suggestive more of semisedentary village occupations than of occupations by nomadic peoples.

Nomadic groups, contemporaneous with Plains Village occupations, also utilized the open prairie in the western part of the state. Without diagnostic ceramics, discrimination between sites representing Plains Village forays and those of nomadic peoples is difficult at best because the basic lithic tool kits are very similar, as are their side-notched arrow points.

EQUESTRIAN NOMADIC TRADITION

The Equestrian Nomadic tradition encompasses the short interval, beginning ca. A.D. 1730, when horses became available to native peoples in North Dakota. It is also the period when Plains Village lifeways were significantly altered by the introduction of European trade goods and devastating diseases. Many tribal identities can be traced through the period using historic records, but archaeological identification of the tribal affiliations of prehistoric sites has been largely unsuccessful.

Beginning about A.D. 1500, the "Little Ice Age" climatic episode brought conditions favorable to grass growth to the Northern Plains. Dendrochronological evidence suggests that precipitation did not markedly increase during this period, but temperatures were lower than the modern norm [Fritts et al. 1979], resulting in lowered rates of evapotranspiration, which promoted lush growth of grass. This in turn resulted in increases in the bison population whose vast numbers so stunned early European explorers and immigrants. Even prior to the horse, the archaeological record suggests increased prehistoric occupations on the plains, likely in part due to movements onto the plains by peripheral groups who were lured onto the prairie by the bison larder. The vast improvement in mobility of the horse over the older dog travois accelerated this movement and lead to the replacement of bison surrounds and pounds by mounted bison hunts.

Expansion onto the prairie by peripheral groups during the Equestrian Nomadic times may in fact be a model of earlier movements of peoples, sans horse, over the last 5,000 years onto the plains. The plains climate is fickle on many time scales--by year, decades, centuries, or millennia--with mesic intervals followed by drought. During moist periods, the seemingly limitless numbers of bison must have been a powerful attraction to native peoples. During the more severe xeric intervals, major declines in the bison population must have brought privation to the resident human population and a decline in their numbers. Ameliorating conditions resulted in a resurgence of the bison and perhaps a new influx of peoples from surrounding areas, some of whom brought new artifact styles.

HISTORIC EUROAMERICAN EXPANSION AND SETTLEMENT

In 1738, Verendrye established a trading post on the Assiniboine River in Canada, and hearing from Assiniboine intermediaries of a light-skinned people (the Mandans or Hidatsa) who knew a river route to the Pacific, promptly set out on an exploring party. Verendrye's party spent the early part of winter at a fortified earth lodge village just north of Bismarck and returned disappointed to Canada in early 1739 after seeing that the Missouri River flowed south rather than west. They are the first known Europeans to visit North Dakota. Parenthetically, the Mandan and Hidatsa did have indirect contact with Pacific Coast tribes via trade networks that brought Pacific shells into their villages.

Other expeditions followed. James Mackay and John Evans ascended the Missouri River in 1794-1796 and, like Verendrye, wintered at the Mandan villages. The upper part of the Missouri River to its confluence with the Yellowstone River was explored by Canadian fur trappers prior to 1800 [Nassatir 1952]. Thus, the Lewis and Clark Expedition of 1805, despite popular impressions to the contrary, was a relative latecomer.

The earliest fur traders were Frenchmen based out of Canada who probably trapped in the region perhaps as early as the 1770s. British interests were represented by the Hudson's Bay Company which was chartered in 1670 and was granted a trade monopoly in all lands draining into Hudson Bay. Reports from the Lewis and Clarke expedition sparked American efforts. Manuel Lisa established the Missouri Fur Company, operating from St. Louis, and sent parties up the Missouri beginning in 1809. Lisa had to abandon his efforts because of hostilities with the Blackfeet, but efforts were renewed in 1822 by competing outfits from the American Fur Company and the Columbia Fur Company.

Because of its strategic importance, the confluence of the Missouri and Yellowstone Rivers was the focus of many early activities. Fort Union was established there in 1830 and became a supply point for trappers. Supplies were first brought to the fort by man powered river boats, but these were supplanted by steamboats, the first of which was the American Fur Company's "Yellowstone" which ascended the river in 1832.

Throughout the early and middle 1800s there is a dismal history of conflict between Native Americans and Euroamericans, and between the Native American tribes themselves. The first action by the United States government was relatively benign, the 1851 Fort Laramie Treaty, which attempted to establish peace between various warring tribes. For the government, peace was desirable because trade could be expanded, but the treaty did little to alter established antagonisms. It did, however, contain the fateful seeds of future treaties: tribes were allotted designated territories which subsequent treaties gradually whittled down to the remnants represented by the modern reservations. If treaties were the carrot, military expeditions and forts were the stick. Fort Buford was established in 1866 and marked the initial step in the military occupation of northwestern North Dakota [Kimball 1930]. In 1874, Fort Buford was assigned to supply the Northern Boundary Survey Expedition with military protection [Eide 1975].

Through the combined effects of epidemic diseases, bison populations decimated by commercial hunting, inter-tribal conflicts, and military campaigns, Native American strength declined in the state throughout the 1800s. The Assiniboine Indians migrated westward into Montana and northward into Canada. The Mandan, Hidatsa, and Arikara tribes were confined to the Fort Berthold Reservation through a series of executive orders and treaties [Shane 1959]. The Native Americans' place was taken by settlers, the first of whom operated ranches.

The earliest ranches in the northwestern part of the state were apparently organized to supply Fort Buford. About 1870, George G. Grinnel started his operation in the Missouri River bottom, ten miles down river from Tobacco Garden in what is now McKenzie County. This evolved into a horse ranch after the surrender of the Sioux in 1881. The Sioux horses were confiscated and a herd of them served as Grinnel's starting stock. In 1885, the Reynolds Brothers Cattle Company brought longhorn herds north into McKenzie County from Texas. They attempted to establish a line camp near Charlson but were dissuaded from their efforts by the Hidatsa chief, Crow-Flies-High [Crawford 1931; Innis 1975].

North of the Missouri River, the White Earth River valley was the site of two early ranches. Edward Hall's trading post became Hall's Horse Ranch, and Eustis and Jamison ran horses from the Souris River to the Montana border [Innis 1975]. Grinnel's ranch was initially established to supply oats and vegetables, but widespread farming did not begin until after about 1885. Essential to this was the necessary combination of reliable transportation and willing people. Railroads supplied the first need and their advertising promotions generated the second. The Great Northern Railway reached Minot in 1887 and Williston in 1888, and the Minneapolis, St. Paul, and Sault Ste. Marie Railway (Soo Line) passed through Minot and reached Portal in present day Burke County in 1893 [Crawford 1931]. The Great Northern was particularly successful in luring settlers to the northwest region, in part because of business necessity: the railroad was built without a land grant and needed passengers and freight to make it a paying proposition. As a consequence, the counties north of the Missouri saw earlier and more substantial homesteading than did counties south of the river [Innis 1975; Heinemeyer 1932].

Massive migrations of people from Northern Europe in the period 1901-1910 brought thousands of land seekers to North Dakota and by 1910, all available amiable land was taken up. The largest ethnic group in the northwest quadrant are of Scandinavian (Swedish, Norwegian, and Danish) origin. Typical homesteads were claimed under the Homestead Act of 1862 which allowed for filing on up to 160 acres. Many land titles show a series of early sales, suggesting that making money by land speculation was almost as significant a motivation as was farming per se.

The more impoverished settlers made due with soddies or tar paper shacks for their housing. Where timber was available, these were replaced by log structures. Log cabins were once common along the Missouri River, but many of these were destroyed during the flood of 1925. Others along the Little Missouri River were taken down by the Civilian Conservation Corps when the Little Missouri National Grassland was created in 1937. The original dwellings on other, more affluent claims were mail order houses sold by companies such as Sears and Roebuck.

Non-agricultural pursuits have been important in the study area. A process was developed in the late 1870s for refining sugar using carbonated bone and a market soon developed for the bleached buffalo bones that littered the prairie surface. This activity last until 1892, by which time the region had been picked clean [Innis 1975]. Lignite mining was another important activity. Many homesteaders dug their own fuel from the numerous lignite beds that outcrop in the region and added to their income by selling coal to towns. Major lignite beds near Kincaid in Burke County and near Noonan in Divide County were developed into large-scale commercial mines by the Truax-Traer Coal Company and by Baukol-Noonan Lignite, Inc. [Oihus 1978]. Lastly, mention should be made of the regional oil fields. The first paying well was drilled in 1951 by Amerada Hess at a location within the project corridor south of Tioga, and the first of several oil booms (and following busts) was initiated [Eide 1975].

Segment 1 Resources: Portions of the 43-mile long corridor for Segment 1 in McLean and Ward Counties have been intensively surveyed for historic properties for other federally sponsored projects. Of the 89 sections searched in the literature review, 79 percent have had some type of cultural resource work done in at least part of the section. The most applicable data were collected on a parallel route in 1978 when Snortland-Coles [1978] surveyed Highway 83 right-of-way. This survey recorded 27 cultural resources; another site was subsequently identified just outside the inventory boundaries. The site density on that survey was 1.8 resources per section. Other surveys in other parts of the two counties recorded higher site densities in areas well removed from the proposed Segment 1 pipeline corridor.

Resources previously recorded in Segment 1 include coal mines, cemeteries, houses, farmsteads, historic scatters of artifacts, livery stable, foundations, township hall, railroad bridge and building, café, motel, garage, and game ranch. Of the 47 resources recorded in Segment 1, only one is identified as eligible for nomination to the National Register of Historic Places. All of the prehistoric sites are tipi rings. Segment 1 crosses the Garrison and Souris River Study Units as outlined in the North Dakota Comprehensive Plan for Historic Preservation [State Historical Society of North Dakota n.d.].

Segments 2 - 8 Resources: The seven segments in Bottineau, Ward, and Renville Counties have a total pipeline length of 147 miles and are in the Souris River Study Unit of the North Dakota Comprehensive Plan for Historic Preservation [State Historical Society of North Dakota n.d.]. Very few cultural resources investigations have been conducted in the area which precludes estimation of local site density. Of the 283 sections transected by the proposed pipeline, 92 percent of these sections lack any record of previous investigations. Of the 46 cultural resources recorded near the proposed corridors through Segments 2-8 , all but six are "site leads;" i.e., unconfirmed or improbable records of resources. None of the site leads have been verified by qualified professionals. Twenty-three are archeological site leads, seven are historic site leads, ten are architectural site leads, and six are architectural sites.

One site in Segment 7, the Renville County Courthouse (32RV256) is listed on the National Register of Historic Places, and a Catholic Church (32RV273) is evaluated as eligible for nomination to the National Register. The significance and integrity of the other resources has not been determined. It is predicted the greatest number and most significant prehistoric sites will be in the Souris River valley.

Segments 9-10 Resources: Seventy-two miles of proposed pipeline would cross Ward and Renville Counties (Segment 9) and Burke and Divide Counties (Segment 10). This area is within the Souris River Study Unit of the North Dakota Comprehensive Plan for Historic Preservation (State Historical Society of North Dakota n.d.). Of the 137 sections searched, professional archeologists, historians, or architectural historians have conducted fieldwork in a minority of the sections (14%). The 53 cultural resources that have been recorded in Segments 9 and 10 include 16 archaeological site leads, 23 historic site leads, three historic sites, nine architectural site leads, and two architectural sites.

National Register recommended eligible or listed sites identified in the area are the McKinney Cemetery (32RV101), the Sebert Hotel (32BK7), a Catholic Church (32DV35), and the Baukol-Noonan coal mine (32BK12 and 32DV11). Based upon data from previous surveys, it is apparent that site densities vary by landform. Densities are lower on the Drift Prairie in Divide and Ward Counties (1.3 sites per section) than on the Missouri Coteau of Divide and Burke Counties (10.5 sites per section) [Fox 1980].

Segments 11- 12 Resources: These segments constitute the northwestern extent of the proposed NAWS projects, and 65 feet of pipeline would be installed in Divide and Williams Counties if an integrated system were constructed. Very little of this part of the Garrison and Souris Study Units [State Historical Society of North Dakota n.d.] has been investigated for cultural resources. Of all of the segments, this is most poorly known in terms of historic properties. Site densities range from 2.4 sites to 5.1 per section in the few locations that have been intensively surveyed.

There are 18 archeological site leads, nine archeological sites, 16 historic site leads, five historic sites, one architectural site lead, and one architectural site in the corridor for Segments 11 and 12. Most of the historic site leads and sites are coal mines. Tipi rings and other rock features constitute most of the archeological sites. Only one site, a Catholic Church (32DV35) has been determined to be eligible for nomination to the National Register of Historic Places.

Segments 13 - 14 Resources: Extending to the southwestern portion of the NAWS project would be 62 miles of pipeline across Ward and Mountrail Counties. Although most of the previous survey efforts are limited in scope and size, only 37 of the 132 sections crossed by the proposed corridor have not had some cultural resource inventory work. A total of 110 cultural resources have been recorded including 48 archeological site leads, nine archeological sites, 33 historic site leads, four historic sites, five architectural site leads, and 11 architectural sites. Cultural resources in the area are coal mines, buildings, town sites, isolated artifacts, buildings, farmsteads, bridge, scatters of artifacts, tipi rings, boy scout camp, grave, rock features, and a church. Only one of these, a bridge (32WD51), has been determined to be significant thus far. Site density in parts of these two segments is as high as 26 sites per section on the Missouri Coteau.

Segments 13 and 14 cross Fort Berthold Reservation. Although there are no known traditional cultural properties in the proposed pipeline corridors, Three Affiliated Tribes has passed Tribal Resolution #96-169-DSB that protects traditional medicinal plants within the boundaries of the reservation. Of particular concern to the tribe is the purple coneflower. Tribal Chairman Russell Mason Sr. has assured Reclamation that protection of this plant does not preclude construction of MR&I projects on the reservation (see Appendix F).

3.9.2. Environmental Consequences

In compliance with the National Historic Preservation Act, Reclamation has initiated consultation with the North Dakota State Historic Preservation Officer (SHPO) and with the Three Affiliated Tribes regarding the proposed NAWS project. Although a Class I literature review has been completed, none of the proposed alternatives have been surveyed at a Class III level (intensive, pedestrian inventory). Such surveys would be completed for all action alternatives.

Reclamation anticipates that additional cultural resources that qualify as historic properties are present but have not yet been identified in pipeline corridors. These resources may potentially be affected by the project. Upon determining pipeline alignments, Reclamation will use the Class I file search to consult with the State Historic Preservation Officer per 36 CFR Part 800.4 to determine which areas would require further Class III, pedestrian cultural resources inventories in the high and medium site potential zones. These inventories would be conducted by a qualified professional archaeologist and be completed before construction begins. In addition, Reclamation would invite the appropriate tribal groups to participate in the consultation process and to assist in the identification of any properties of traditional religious and cultural importance that may be affected.

Should any buildings, structures, sites, objects, or districts or properties of traditional religious and cultural importance be discovered that qualify as historic properties, Reclamation would consult with the State Historic Preservation Office to determine whether any qualify as historic properties and to determine the effects of construction activities on the properties per 36 CFR Parts 800.4 and 800.5. Any avoidance or mitigation measures would be instituted before construction begins. If unanticipated cultural resources are encountered during construction, all ground disturbing activities in the immediate area of the resource would be stopped until Reclamation can consult with the State Historic Preservation Office and evaluate the resource per 36 CFR Part 800.13.

Alternative A — Integrated System

Comparison of the impacts of the alternatives is based upon the information gathered by a literature review and does not include any intensive cultural resource inventories of pipeline alignment. Therefore, the impacts are estimated rather than known. Alternative A disturbs the largest cumulative ground surface and has the highest potential of the three to adversely affect historic properties.

Alternative B — Upgrade of Existing Systems

Because Alternative B disturbs the least ground of the three action alternatives, it has the smallest potential to impact historic properties.

Preferred Alternative — Combination of Alternatives A and B

The Preferred Alternative has less potential than Alternative A for impacts, but greater potential than Alternative B to damage historic properties. However, the environmental commitments should be sufficient to protect historic properties from adverse effects regardless of the selected alternative.

No Action Alternative

The No Action Alternative would have no effect on historic properties.

3.10 Paleontological Resources

3.10.1 Affected Environment

The proposed NAWS project would cross three physiographic regions in North Dakota - the Drift Prairie of Central Lowlands in Divide, Burke, Renville, Bottineau and Ward (Reaches 2-10 and Part of Reach 11), a margin of the Missouri Plateau in Williams County (Part of Reach 12), and the Missouri Coteau (Reaches 1, 13, 14). Olson [1998] describes the geology of the project as follows:

> The Drift Plains are characterized by flat, ground moraine plains with little relief. The plains have a mantle of Pleistocene glacial drift sediments overlying an erosional surface that was beveled nearly flat by repeated advances of Pleistocene continental glaciers. Many small ponds and marshes dot the surface, reflecting a drainage system that overall is poorly developed [Hainer 1956]. The major drainage in the project area is the Souris River and its principal tributaries are the Des Lacs River Deep River fed by Cut Bank Creek and Little Deep Creek, Wintering River and Willow Creek with its tributary, Ox Creek.

The Missouri Plateau in Williams County is covered by a thick deposit of glacial drift [Hainer 1956]. Drainages here are more integrated than on the Drift Prairie of the Missouri Coteau and there are fewer ponds and wetlands [Freers 1973]. Drainages are typically intermittent or ephemeral and all drain into the Missouri River.

The Missouri Coteau is also the product of continental glaciation. The Coteau rises 100-150m. (300-400 feet) above the general level of the adjacent Drift Prairie and is buttressed against the Missouri Plateau. The dominant topographic feature of the Coteau is hummock, knob-and-kettle terrain which was created when continental glaciers stagnated in place. Portions of these glaciers were covered with a thick insulating mantle of supra-glacial draft which retarded melting of the underlying ice relative to areas without (or with less of) an insulating cover. Covered areas eventually became the potholes and wetlands seen today. The modern knobs are composed of drift and outwash that was concentrated by slumping and flow into more rapidly melting areas of the glaciers [Clayton 1967].

Glacial sediments form a covering as great as 500 to 600 feet thick on top of bedrock in places on the Missouri Coteau [Bluemle 1991]. Near Kenmare, Renville County, such sediments are 800 feet thick, the deepest glacial deposits in the state [ibid].

North Dakota Geological Survey has provided a list of paleontological resources for Dunn, McLean, Mountrail, McKenzie, and Ward Counties on the Fort Berthold Reservation (Reaches 12 and 13). Lists of fossil resources for the other reaches would be compiled during the planning phase of the project. Although there has been little paleonotological research on the reservation to date, there are, "undoubtably many more undiscovered sites particularly along the banks of Lake Sakakawea and tributaries to the lake. Paleocene age (about 50 million to 60 million years old) rocks are found on Fort Berthold Indian Reservation. Elsewhere these rocks contain the fossil remains of plants (petrified wood and leaves), invertebrates (freshwater snails and clams), and vertebrates (including turtles, crocodiles, alligators, crocodile-like champsosaurs, mammals, etc.) Sites containing these kinds of fossils would be found on Fort Berthold with some searching" [Hoganson 1996].

Most of the surface geology in the proposed NAWS service area is covered with Pleistocene Coleharbor Group sediments. Such sediments have produced abundant fossils in parts of North Dakota. Such fossils include tree and other plant pollen, fish, aquatic snail and clam shells, land snails, insects, ostracods, and bones from beaver, caribou, elk, mammoth, and bison [Bluemle 1991].

3.10.2 Environmental Consequences

Comparison of the impacts of the alternatives is based upon a search of North Dakota Geological Survey's database for information on recorded fossils located on Fort Berthold Reservation and on information published in Bluemle [1991] for non-reservation lands. Therefore, the impacts are estimated rather than known.

Reclamation has entered into a cooperative agreement with North Dakota Geological Survey regarding paleontological resources. Under this agreement, North Dakota Geological Survey would provide Reclamation with the locations of all known fossil sites in the vicinity of pipeline corridors. All previously recorded paleontological resources and paleontologically sensitive zones within the path of the proposed project would be inspected in the field by a qualified paleontologist. Avoidance measures would then be developed to avoid significant resources. Also, Reclamation would consult with North Dakota Geological Survey about the need for paleontological survey of areas likely to contain significant fossils. Such surveys would be completed prior to project construction. Based upon survey data, Reclamation would consult with North Dakota Geological Survey about revising routes to avoid damaging significant fossil locations.

Alternative A — Integrated System

The integrated system in Alternative A disturbs the largest cumulative area. Of the three construction alternatives, it has the highest potential to adversely affect fossil resources.

Alternative B — Upgrade of Existing Systems

An upgrade of existing systems disturbs the fewest geological formations and sediments of the three construction alternatives; it thus has the smallest potential to impact fossil resources.

Preferred Alternative — Combination of Alternatives A and B

The combination system of the Preferred Alternative has less potential than Alternative A for negative impacts, but it has greater potential than Alternative B to damage fossil resources. However, the environmental commitments should be sufficient to protect significant paleontological sites from adverse effects regardless of the selected alternative.

No Action Alternative

The No Action Alternative would have no effect on significant paleontological resources.

3.11 Social/Economic

3.11.1 Affected Environment

The project area is typical of rural and small town areas of the Great Plains in that farming and ranching families, most being descendants of original homesteaders, provide a dominating social influence. Lifestyles reflect traditional, conservative values characterized by strong inter-personal bonds based on shared ideas, trust, and community activities.

The largest industry in the project area is agriculture and the economic infrastructure is based on agriculture. Historically, this meant a density of one to four farms per square mile, with associated thriving and growing communities. The drought of the 1930s and subsequent economic and social changes since then have resulted in a constant drop in the density of farms in North Dakota. Consequently, many small towns also saw a drop in their populations; the subsequent commerce that was associated with farms and people also dropped. Many of today's small towns within the project area have lost significant population so they can no longer support commerce and schools or afford police protection. Underemployment in small communities is also an economic problem. Most jobs that are available pay below the statewide average, mostly because manufacturing jobs are scarce.

The farm economy, however, has remained healthy in the past five years and has contributed significantly to the state's economy. Average per capita income for the eight counties in 1994 was $18,786; the average statewide per capita income was $18,738. The average unemployment rate for the eight counties in October 1996 was 2.4 percent; the statewide unemployment rate was 1.9 percent [Job Service North Dakota 1996].

Most of the small communities and farms in the project area are using water of poor quality and in some instances of limited quantity. In prolonged drought similar to the 1930s, water shortages would occur within the eight-county area, including Minot.

Some water consumed by people within the project area is negatively impacting their health. The Environmental Protection Agency has suggested a guidance level for sodium of 20 mg/L in drinking water for high risk populations (e.g. individuals with a genetic predisposition to hypertension, pregnant women, and hypertensive patients) as recommended by the American Heart Association. The North Dakota Department of Health has taken a position that 200 mg/L is a reasonable limit for the normal population [Houston Engineering et al. 1993a]. Nine of the 19 NAWS contract users have sodium levels greater than 200 and all have sodium levels greater than 20 [Houston Engineering et al. 1997a].

Improvements in water quality and quantity in other parts of the state have had a positive impact on providing water for industrial growth, on livestock production, and on residents' general quality of life.

3.11.2 Environmental Consequences

Alternative A — Integrated System

A reliable source of good quality water would have positive economic and social impacts on individuals and communities as a whole. Potential health problems associated with the consumption of poor quality water, especially water high in sodium, would be reduced with the reduction of sodium to 100 mg/L. Increased water supplies would allow for the expansion of industries needing a reliable, high quality water supply. Livestock growers would benefit from a better supply of good quality water.

The construction of a regional water supply system would provide a short-term infusion of capital into the local economies of the area. Construction would provide increased employment and spending in the local communities by construction workers. Construction would have minor, short-term impacts on housing and community services. On the negative side, some jobs may be lost because of the elimination of a local treatment plant or the delegation of jobs to district rural water personnel. However, other jobs would be created in the operation and maintenance staffs of the major water supply systems. On the whole, more jobs requiring higher skill levels would be created by development of the NAWS project.

A reliable supply of good quality water may also make the communities attractive to people who work and currently live in larger communities in the area, resulting in the development of "bedroom" communities in outlying areas.

Alternative B — Upgrade of Existing Systems

The impacts would be almost the same as listed in Alternative A, except the increased operating costs would make water more expensive, approximately 65 percent higher than Alternative A or the Preferred Alternative. See Table 1. Also, it may be difficult for communities to maintain individual treatment plants because of the need to employ qualified plant operators.

Preferred Alternative — Combination of Alternatives A and B

The impacts would be the same as listed in Alternative A.

No Action Alternative

Taking no action would not provide a safe, reliable source of water to residents of the eight-county project area. No employment would be created if the project was not constructed, and that potential would be lost. The social and economic well-being of some of the project communities would continue to degrade because of the lack of safe, reliable water. It may become increasingly infeasible for some small rural communities to economically meet the future EPA Safe Drinking Water Act standards. Higher costs to test and treat water may result in the abandonment of small treatment facilities to the detriment of local populations and water supplies.

3.12 Land Use and Ownership

3.12.1 Affected Environment

Land use in the project area is predominately dryland crop production and livestock grazing. About 95 percent of the project lands are privately owned. Most of these privately owned lands are farms and ranches made up of roughly 72 percent agricultural land and 28 percent rangeland/prairie.

The Three Affiliated Tribes own scattered tracts of Trust Land on the Fort Berthold Indian Reservation in McLean and Mountrail Counties north of the Missouri River. Indian lands make up a patchwork of ownership within the reservation boundaries; this cropland and rangeland is leased or farmed by the Indian owners. The Bureau of Reclamation has specific responsibilities under the Indian Trust Policy issued July 2, 1993 to address the environmental impacts on Indian Trust Assets. Indian Trust Assets are covered in Section 3.13.

An assessment of public lands that may be affected by proposed pipeline corridors follows.

Bureau of Land Management Lands:

Lands managed by the Bureau of Land Management in the NAWS project area are those not sold by the Federal government during the homestead days. The majority of these lands are saline wetland complexes. The specific locations of these lands in the project area can be obtained from the Bureau of Land Management office in Dickinson, North Dakota.

State Land Department Lands:

The pipeline corridors would cross scattered tracts of state school land and land conveyed to the state for non-payment of taxes. This land is mainly pasture with a very small percentage of cropland.

North Dakota Game and Fish Department Lands:

The North Dakota Game and Fish Department manages lands adjacent to Lake Sakakawea and Lake Audubon as well as scattered tracts in state wildlife management areas.

U.S. Fish and Wildlife Service Lands:

The U.S. Fish and Wildlife Service manages five national wildlife refuges (NWR) within the NAWS project area. Four of these refuges would be crossed by proposed pipelines: J. Clark Salyer NWR, Upper Souris NWR, Des Lacs NWR, and Lake Zahl NWR.

The U.S. Fish and Wildlife Service also manages a large number of wetland easement areas and waterfowl production areas.

U.S. Army Corps of Engineers:

The U.S. Army Corps of Engineers owns all of the land surrounding Lakes Audubon and Sakakawea. Most of the Corps' land near the proposed pipeline is leased to the North Dakota Game and Fish Department and managed as Wildlife Management Areas. The pipeline would likely cross Corps lands when it leaves the intake. The intake facility would also be located on Corps land.

Designated Scenic Areas

The pipeline corridors or facility upgrades do not cross any designated scenic areas or state park lands.

Other Land Uses

There are major deposits of coal and potash in the northwestern corner of the project area in Williams, Divide, and Burke Counties, and additional coal reserves lie in the Garrison area in central McLean County. None of the areas identified as major reserves of coal or potash are currently being mined. The major mining companies and the North Dakota Public Service Commission were contacted, and no major mining activities are scheduled to begin in the next to 10 years.

There are major oil fields in Burke, Renville, and Bottineau Counties. These fields are crossed by interconnecting oil and gas supply lines which are approximately three to four feet below the surface. All water-supply lines would be located below these other lines; where appropriate, joints would be encased.

A feature that has caused problems for design and construction of rural water systems in the past is the high number of buried power and telephone lines that must be crossed. The impact caused by the crossing of these utility lines is economical rather than environmental, and it adds a substantial cost to the project. The final design would have to include consultations with all power and telephone companies and rural water districts in the area to ensure that all lines are properly located.

The U.S. Air Force has constructed extensive missile installations across the eight northwestern counties. These missile silos, missile control stations, and bases are connected by an extensive underground communication system. Inadvertent damage to one of these missile cables would cause serious problems for all concerned. Design plans would be submitted to the U.S. Air Force to ensure that all Air Force facilities are properly located.

3.12.2 Environmental Consequences

Alternative A — Integrated System

Private Lands

The main impact to land use on private lands would be temporary loss of cropland, rangeland, and hayland use during and after construction, until reclamation is completed. Landowners would be compensated for their losses through easement payments. The state would retain an easement on the pipeline right-of-way to manage and maintain the pipeline. When maintenance is needed, landowners would again lose temporary use of their lands.

Public Lands

The pipeline would cross lands managed by the North Dakota Game and Fish Department at Lake Audubon or Lake Sakakawea. The Game and Fish Department has identified various Wildlife Management Areas and numerous lakes which are contained within the project boundary. The Game and Fish Department has requested that their Bismarck office be contacted if any of these lands or water bodies would be traversed by any portion of the proposed project.

The pipeline would not cross lands owned or managed by the U.S. Bureau of Land Management. Approximately 0.1 percent of the proposed pipeline crosses land controlled by the State Land Department.

Land owned and managed by the U.S. Fish and Wildlife Service would be crossed by construction of the proposed pipeline. Specifically, four national wildlife refuges would be crossed. These refuges and the lengths of crossings are provided in Table 14. Final design would attempt to keep the pipelines within highway rights-of-way when crossing national wildlife refuges. Construction on refuges would be deferred until after July 15 to decrease disruption of waterfowl and other wildlife during the nesting season. Proper permits would be obtained from the U.S. Fish and Wildlife Service prior to construction.

Approximately ten percent of the proposed pipeline corridors cross U.S. Fish and Wildlife Service easement lands. These easements do not extend onto highway rights-of-way, but it would become necessary to locate some segments of the pipeline on Fish and Wildlife Service easement lands. All of the easement lands have been identified that are either adjacent to or crossed by the proposed pipeline corridors. Maps showing the locations of these easements are on file at the offices of American Engineering, P.C. in Bismarck and the realty office of the U.S.

Fish and Wildlife Service. Table 15 contains a summary of the number of easement miles crossed by each segment of the proposed pipeline.

It is anticipated that only temporary impacts would occur on these easement lands. When final locations for the pipeline are established, specific impacts would be assessed, permits would be obtained and additional mitigation measures would be provided if necessary.

Consultation with the U.S. Fish and Wildlife Service has begun to inform them of the project and potential impacts to U.S. Fish and Wildlife Service property and easements. Consultation would continue as the project moves into the final design phase to ensure that impacts on U.S. Fish and Wildlife Service properties are avoided, minimized or mitigated, and that proper permits are obtained.

Table 14. National Wildlife Refuges crossed by construction of the NAWS pipeline.

Refuge	Length of Crossing (miles)
J. Clark Salyer National Wildlife Refuge	1.0
Upper Souris National Wildlife Refuge	1.5
Des Lacs Lake National Wildlife Refuge	1.0
Lake Zahl National Wildlife Refuge	2.25

Other Land Uses

The area of major coal reserves crossed by the proposed pipeline corridor is in the Noonan area. Several mines operated in the area up until 1980, but they have since closed. The pipeline corridors are all located adjacent to major paved highways which have not been disturbed by past mining operations.

The crossing of oil and gas pipelines by the water supply pipelines would require proper consultation and engineering design. The proposed pipeline along State Highway 5 in the northern part of the project area would encounter the most oil and gas pipelines. During the final design stage, all oil and gas lines would have to be identified and measures taken to protect them during construction.

When final pipeline routes are selected the designer must meet with the U.S. Air Force to prevent any disturbance of their communication network and ensure that the exact location(s) of the communication cables are shown on the plans. This should eliminate any impacts to U.S. Air Force communication systems.

Table 15. U.S. Fish and Wildlife Service easement lands along the NAWS pipeline route.

Segment Number	Segment Length (miles)	Easement (miles)	Percentage Easement
1	44.4	4.5	10.1
2	39.7	2.25	5.7
3	49.0	4.0	8.2
4	8.0	0.0	0.0
5	6.0	1.0	16.7
6	14.0	6.0	42.9
7	9.0	0.5	5.6
8	13.5	4.0	29.6
9	37.0	3.5	9.5
10	41.0	5.0	12.2
11	27.2	0.0	0.0
12	38.7	4.75	12.3
13	21.6	0.5	2.3
14	42.6	3.5	8.2
15	19.8	2.5	12.6
TOTAL	**411.5**	**42.0**	**10.2**

Alternative B — Upgrade of Existing Systems

The impact to land use and ownership would be placement and construction of brine ponds and new water treatment plants. Prime farmland would be avoided, as well as U.S. Fish and Wildlife Service easement lands. Locations of electric utilities, oil and gas pipelines, and U.S. Air Force communication systems would be avoided as in Alternative A.

Preferred Alternative — Combination of Alternatives A and B

Impacts would be the same as Alternative A, except there would be fewer U.S. Fish and Wildlife Service easement lands affected. Segments 11, 12, and 14 would not be built, eliminating impacts to 8.25 easement miles. Because the pipeline would not cross Zahl Lake National Wildlife Refuge, it would not be impacted by this alternative.

No Action Alternative

There would be no impacts to land use and ownership if the No Action Alternative is followed.

3.13 Indian Trust Assets

Indian Trust Assets are defined as "legal interests in property held in trust by the United States for Indian tribes or individuals." This definition is from a policy directive on Indian Trust Assets issued by the Commissioner of the Bureau of Reclamation on July 2, 1993. Examples of Indian Trust Assets include lands, minerals, timber, hunting and fishing rights, water rights, and in-stream flows. In general, this definition parallels that for "trust resources" in the implementing regulations for the Indian Self-Determination and Education Assistance Act, 25 CFR Part 900.6:

> "*Trust resources* means an interest in land, water, minerals, funds or other assets or property which is held by the United States in trust for an Indian tribe or an individual Indian or which is held by an Indian tribe or Indian subject to a restriction on alienation imposed by the United States."

Indian Trust Assets are those properties, interests, or assets of an Indian tribe or individual Indian over which the federal government also has an interest, either through administration or direct control. The federal government acts in a fiduciary or trust capacity with respect to these properties, interests, or assets.

Reclamation's Indian Trust Assets policy was developed in response to the federal American Indian policy issued by former President Bush on June 14, 1991, that reaffirms the government-to-government relationship between Federal agencies and tribal governments. President Clinton issued a memorandum on April 29, 1994, that further reaffirms this relationship. These policies and directives resulted in the Department of Interior's "Departmental Responsibilities for Indian Trust Resources" (512 DIM Chapter 2). The DIM states:

> "It is the policy of the Department of Interior to recognize and fulfill its legal obligations to identify, protect, and conserve the trust resources of federally recognized Indian tribes and tribal members, and to consult with tribes on a government-to-government basis whenever plans or actions affect tribal trust resources, trust assets, or tribal health and safety."

The concept of Indian Trust Assets reflects the sovereignty of federally recognized tribes and the government-to-government, trust relationship between Federal agencies such as Reclamation and these tribes and individual Indians. The purpose of the Reclamation Indian Trust Asset policy is to maintain this government-to-government, trust relationship by ensuring that effects on Indian assets are considered in the planning and implementation of Reclamation actions. The DIM specifies that each bureau and office must identify any potential affects that their activities may have on Indian Trust Assets. Any effect must be explicitly addressed in planning/decision documents, such as those prepared in association with the NEPA process. All Reclamation NEPA documents are to have separate sections that discuss Indian Trust Assets and whether the proposed action(s) would have an impact on any asset(s).

3.13.1 Affected Environment

The Fort Berthold Reservation, governed by the Three Affiliated Tribes, is included in the NAWS project area. Any portions of the system that enter the reservation and cross trust lands, either those of the Tribe or of individual Indian land owners, would affect Indian Trust Assets. The United States hold such lands in trust for the Tribe or the individual Indian land owner. As such, these lands constitute trust resources.

3.13.2 Environmental Consequences

Alternative A — Integrated System

The pipeline would cross 1.75 miles of the Forth Berthold Indian Reservation, from Parshall to the Reservation boundary. The pipeline would not cross any trust land that is either owned by the Tribe or individual Indian land owners. Easements for the pipeline would be secured according to 25 CFR Part 169 - Rights-of-Way Over Indian Lands. In part, this would require the consent of the landowner(s), with concurrence from the Bureau of Indian Affairs.

Since the intake structure would be downstream from the Reservation, no Winters Doctrine water rights are involved. The system also would provide water to both the Native American and non-Native American residents of Parshall. Since the Native American residents would be paying for their water the same as the non-Native American residents, the water provided to the Native American residents should not count against any settlement should the Tribe, in the future, chose to quantify their water rights.

Several reservations border the Missouri River downstream from the intake. These include the Standing Rock Reservation in both North and South Dakota, and Lower Brule and Crow Creek reservations in South Dakota. None of these tribes have expressed interest in negotiating a water rights settlement although all have stated a right to waters in the Missouri under the Winters Doctrine. Should these tribes pursue a settlement of their Winters Doctrine rights, such settlement(s) could potentially affect the waters available for the NAWS system.

Alternative B — Upgrade of Existing Systems

No Indian Trust Assets would be affected by Alternative B.

Preferred Alternative — Combination of Alternatives A and B

The pipeline would not cross the Fort Berthold Indian Reservation so it would not cross any trust land that is either owned by the Three Affiliated Tribes or individual Indian landowners.

The intake structure for the Parshall portion of the system, which would be serving both Indians and non-Indians, would be located along that portion of the Missouri River within the Reservation. However, the amount of water removed to serve Parshall should not affect the water available to the Tribe if, in the future, they should chose to quantify their water rights. Further, since the residents of Parshall, both Native American and non-Native American, would be paying for their water, the water provided to the Native American residents should not count against any quantification settlement. The same conditions under the Winters Doctrine apply to this alternative as for Alternative A.

No Action Alternative

No Indian Trust Assets would be affected by the No Action Alternative.

3.14 Aesthetics

3.14.1 Affected Environment

The project area is predominantly farmland and rangeland. The landscape is characterized by broad open horizons and large sky. It is dominated by fields of cropland and farmsteads interspersed with small towns. Most of the land is gently rolling or relatively flat. Shelterbelts and wetlands are scattered across the land, breaking up the horizon and providing diverse wildlife habitats. Migratory waterfowl in the spring and fall can be seen in large flocks in the sky and on bodies of water. Large and small electrical transmission lines cross the landscape, mostly along road rights-of-way.

3.14.2 Environmental Consequences

Alternative A — Integrated System

Visual impacts from construction of the 413-mile long pipeline would take place mainly during construction. Noise from heavy equipment would detract from the usual noises and sounds of the prairie and farmland. During operation, noise would be generated by pumping stations and the intake facility, which would be reduced by placing them in buildings.

Once the pipeline is built and vegetation is replanted over the pipeline, it would not be visible in most places, except where native prairie and native woodlands are disrupted. Where this disruption occurs, the pipeline route could be visible for up to 20 years until native vegetation completely dominates. Topography should remain the same, so it would not be affected.

The 27 pumping stations and one intake facility built along the pipeline route would be visible on the landscape. Although other new facilities would also be visible, most of them would have minimal impacts because of their locations in existing towns. Storage reservoirs outside of towns would be painted to blend in with the environment.

Alternative B — Upgrade of Existing Systems

New treatment units that are placed in existing water treatment plants would not affect the aesthetics of the area. New water treatment plants would be built in 13 communities; these buildings would be planned to be aesthetically pleasing.

Wastewater treatment ponds could negatively affect the aesthetics in the communities they serve. Pond sizes, which are provided in Description of Alternatives under Section 2.2, range from 2.2 acres in Souris to 83.8 in Bottineau. Minot's equalization pond would be 110 acres. The wastewater ponds would be placed within one mile of treatment plants, which are located near or in the NAWS communities. The ponds would not enhance the beauty of the area. Although they would be odorless, they would not grow vegetation and are not likely to attract wildlife.

Preferred Alternative — Combination of Alternatives A and B

The impacts would be a combination of those under Alternatives A and B. Where pipelines are built, the impacts would be the same as under Alternative A. Where treatment facilities are upgraded, the impacts would be the same as under Alternative B.

No Action Alternative

There would be no effect on aesthetics under the No Action Alternative.

4.0 Indirect and Cumulative Impacts

Indirect impacts are those that would follow project activities associated with NAWS, but which are not a direct result of project construction and implementation. An example of an indirect impact to the environment would be development of industries, such as livestock feedlots, which are able to develop and compete because of an abundant supply of high quality water. A livestock feedlot would promote the economic well-being of a local community and the state, but it could potentially result in negative impacts to surface and groundwater quality if not properly designed and operated. The purpose for the proposed NAWS project is to provide a reliable source of high quality water to northwestern North Dakota for municipal, rural, and industrial uses.

The primary focus of the NAWS project would be water for municipal and rural uses, with industrial uses being secondary. Because the NAWS project would provide quality water of adequate quantity to cities, small communities, and rural areas in northwestern North Dakota, there is no doubt that economies will benefit and development will be facilitated. All action alternatives, however, would essentially result in similar indirect impacts.

One beneficial, indirect impact would be an improved quality of life for residents who have access to NAWS water. It is likely that health problems associated with water high in minerals, TDS, sodium, and sulfate would be reduced. Residents would enjoy the positive impacts of high quality water for clothes washing, lawn watering, and other domestic uses.

Businesses that are dependent on high quality water, such as restaurants, greenhouses, and plant nurseries would see improved product quality. New industries, such as food processing plants, could also develop. Actual environmental impacts related to growth would depend on the effectiveness of local planning and zoning. If the cities and communities that are involved in these business expansions have proper zoning and environmental ordinances, their environmental impacts would be kept to a minimum, and where possible, should be mitigated. Where communities do not have safeguards, the regional planning councils should assist them in developing ordinances that safeguard their citizens while providing for economic growth and development. In addition, many state and federal regulations apply to air and water quality standards that new industry would have to follow to safeguard citizens.

Cumulative impacts are those impacts which result from the incremental impact of an action when added to other past, present and reasonably foreseeable future actions. Two areas of potential cumulative impacts exist for the proposed NAWS project; water withdrawals from the Missouri and transfer of biota to the Hudson Bay basin.

Flows down the Missouri River through Lake Sakakawea average 16,527,000 acre-feet per year for the period of record of 1967-1999 (U.S. Army Corps of Engineers, web site http://www.nwd-mr.usace.army.mil/rcc/projdata/garrods.html). The NAWS project will withdraw approximately 10,500 acre-feet per year from the Missouri River system via Lake Sakakawea or Lake Audubon; this constitutes approximately 0.00058 per cent of the current average annual flow. Cumulative impacts could accrue in conjunction with other future withdrawals along the system. However, the incremental effect of the NAWS withdrawal, when added to other past, present, and reasonably foreseeable future withdrawals from the Missouri River system, will not be measurable below Lake Sakakawea.

The risk of interbasin transfer of non-native biota as a result of the NAWS project is considered low, given the treatment methods and additional safeguards built into normal operation and maintenance programs for the project. The incremental risk of interbasin transfer of non-native biota from the proposed project, when added to the risk which may result from other future interbasin transfers (none are reasonably foreseeable at the present time), is also considered to be low, assuming that such additional transfers are accompanied by adequate treatment methods and safeguards. Any future interbasin transfers would require additional environmental review, consultation with Canada, and Federal approval before they would be authorized.

5.0 Relationship Between Short-Term and Long-Term Productivity

There are three key production indexes to evaluate: agriculture, water, and economic. For purposes of evaluating productivity, impacts from the Preferred Alternative, which would be the proposed alternative, will be addressed.

Agriculture

Long-term impacts to agricultural productivity by NAWS should be positive, except where permanent facilities replace cropland or rangeland. NAWS water would not be used for irrigation, but where producers wish to develop irrigation, the NAWS project would reduce competition for groundwater. Thus, it should be easier for producers to improve agricultural productivity through irrigation. Ranchers who use rural water for livestock watering would likely see an improvement in the long-term production of cattle.

Water

There should be little difference in short-term availability of water under the Preferred Alternative. Long-term availability of groundwater would probably increase when the demand for water from area aquifers is not so extensive. The groundwater aquifers in the Souris River basin would have a better chance to recharge themselves and deliver water into the river system. In addition, wastewater from Minot's sewage treatment plant would be processed and discharged into the Souris River.

Economic

Economic opportunities should increase over time as the value of good quality water is recognized and used by recipients.

6.0 Irreversible and Irretrievable Commitments of Resources

The resources used to build the pipe for the pipeline and to build the permanent facilities are not retrievable. Where groundwater is used for the project, there is a chance of depleting the aquifer, which could take time to replenish, depending on the location of the aquifer and its water source.

One of the greatest concerns for irreversible commitments of resources is interbasin biota transfer. Most often, when this occurs, the damage is not reversible. The NAWS project is taking many precautions to ensure that this does not happen (see Section 3.6).

There are no other irreversible and irretrievable commitments of resources that we are aware of. Most impacts would be temporary, and where necessary, would be mitigated.

7.0 Consultation and Coordination

7.1 Agency Coordination

An interdisciplinary team was established to provide expertise among disciplines, and also to ensure coordination between key agencies and consultants. The interdisciplinary team membership included the State Water Commission, Reclamation, and consultants.

The following agencies were contacted during preparation of this assessment:

- U.S. Fish and Wildlife Service. Contacted for consultation required under the Endangered Species Act and the Fish and Wildlife Coordination Act (Appendix G). Refuge and easement interest in land was also accessed to identify possible impacts from the project. The U.S. Fish and Wildlife Service's National Wetland Inventory information was used to estimate impacts to wetlands.

- U.S. Army Corps of Engineers. Contacted to discuss possible impacts to Corps of Engineers managed lands along Lake Sakakawea or Lake Audubon.

- Natural Resources Conservation Service. Contacted to obtain information on prime farmland soils, vegetation, and the Conservation Reserve Program.

- North Dakota Game and Fish Department. Representatives of the Department met with staff from Reclamation, the State Water Commission, and BlueStem Incorporated to describe the project and to request recommendations for consultation.

- North Dakota Department of Health. Contacted the Drinking Water Program Section about disinfection credits under the Surface Water Treatment Rule (Appendix B).

- North Dakota Department of Agriculture. The Agriculture Commissioner is a member of the North Dakota State Water Commission and as a member has received periodic updates and acted as a decision maker on the project through regular State Water Commission meetings.

- North Dakota Parks and Recreation Department. Contacted to request information on lands and natural areas that they own or administer that might be impacted by the project.

- North Dakota State Historic Preservation Office. Accessed their files for the Class I Archeological Inventory. They have a Memorandum of Agreement with Reclamation regarding coordination and clearance for impacts to historic properties.

7.2 Public Input

Public input and coordination has been ongoing since the beginning planning stages of the NAWS project. A survey was conducted in 1987 to gage MR&I interest and need. Each potential contract user was contacted individually to gage their interest in the project. A series of public meetings was held in 1993 prior to the pre-final design work. The NAWS Advisory Committee continues to provide an opportunity for interested parties to provide feedback and input to the decision making process.

A fact sheet was compiled in early 1997 and sent, with a return post card, to members of the public who had previously expressed interest in the NAWS project. The fact sheet was also sent to all communities that would be affected by the project, all county commissions in the eight-county region, and all county water boards that would be affected. One of the purposes of the fact sheet was to identify unknown issues. No new issues were identified through this process. Concerns and suggestions were compiled and are on file at Reclamation and State Water Commission offices.

The draft EA was distributed to agencies, organizations, and individuals who have an interest in the NAWS project. The distribution list is provided in Appendix H. Letters of comment were received from: North Dakota Highway Department, North Dakota Department of Health, Garrison Diversion Conservancy District, U.S. Environmental Protection Agency, North Dakota Game and Fish Department, Dr. Gary Pearson, Manitoba Environment, Canadian Section of the Garrison Joint Technical Committee, U.S. Natural Resources Conservation Service, and U.S. Fish and Wildlife Service.

Three public meetings were held on the project and draft environmental assessment in July 1997. One was held in Minot on July 22, one in Bowbells on July 23, and one in Bottineau on July 24. Twenty people attended the Minot meeting. Thirteen people attended the Bowbells meeting. Ten people attended the Bottineau meeting.

The objectives of the meetings were to update interested persons about progress on NAWS studies, to explain the alternatives in the environmental assessment, and to receive comments from participants about the project and the NEPA requirements. Representatives from BlueStem Incorporated, the North Dakota State Water Commission, and the U.S. Bureau of Reclamation facilitated the meeting. The meeting began by providing the status of the NAWS project. The four alternatives listed in the Environmental Assessment were explained. Participants were notified of the process that would be used to receive comments and make a final decision to meet

NEPA requirements. The floor was open to a facilitated comment/question and answer period. Participants were also allowed to provide written comments on comment cards that were provided at the meeting.

Most of the questions and concerns at all three meetings dealt with project cost and schedule. General project concerns focused on making sure the project was sized adequately to add more communities or individual users later, getting water to communities in a timely manner, understanding when communities and individuals would begin to pay for water and what the costs would be, and coordinating with existing facilities. Specific concerns and questions about the environmental assessment related to the issue of Canadian consultation; many were concerned that consultation and studies developed to meet Canadian concerns were excessive. At the Bottineau meeting, participants asked if Bottineau could provide water to the east branch of NAWS using ground water and a nanofiltration system, if the current NAWS plan is dropped.

Responses to all written comments, including those received during the public meetings, are provided as an appendix to the final decision document.

8.0 Environmental Compliance

8.1 Environmental Commitments

Numerous environmental commitments are made to ensure that impacts of construction of NAWS facilities are kept to a minimum. The State Water Commission and NAWS Advisory Committee are committed to these environmental measures to reduce negative project impacts; the Bureau of Reclamation is responsible for ensuring these commitments are followed. These environmental commitments provide for impact avoidance whenever practical. Where avoidance is not possible, the commitments ensure that impacts are minimized or mitigated.

To ensure these environmental commitments would be met, an Impact Mitigation Assessment team would be formed to monitor the final design, construction, reclamation, and operation of the NAWS project. The Impact Mitigation Assessment team would be composed of environmental specialists from Reclamation, the State Water Commission and other project sponsors, consulting engineers, U.S. Fish and Wildlife Service, and the North Dakota Game and Fish Department. When construction takes place on lands administered by other agencies or on private lands, specialists of the agencies or landowners would be invited to become members of the team for that part of the construction affecting them.

Prior to annual construction activities, the Impact Mitigation Assessment team would review work plans in order to avoid any impacts and to suggest plan modification or mitigation. After each construction season is completed, a review of the facilities would be undertaken by the Impact Mitigation Assessment team to determine if any impacts have occurred in order to enter mitigation requirements into the Bureau of Reclamation's Garrison Diversion Unit ledger. Project impacts, mitigation, and other recommendations of the Impact Mitigation Assessment team would be entered on a ledger for ongoing resolution prior to project completion. Mitigation would be on an acre-for-acre basis, based on ecological equivalency, and would be completed concurrently with project construction. Any changes in the construction program warranting additional National Environmental Policy Act compliance would be addressed by the Impact Mitigation Assessment team.

The following environmental commitments are made to reduce environmental impacts of the NAWS project.

8.1.1 Geology, Topography, and Soils

- Construct pipelines adjacent to existing highways and roadways where practical. Pipelines may be constructed within roadway rights-of-way when it presents advantages.
- Strip and respread topsoil on pipeline corridors, pump station sites, and all rights-of-way, except when the pipeline is installed by a trencher or plow. Where topsoil depth exceeds 12 inches, salvage the top 12 inches. Gravel may be placed around the edge of pump stations and storage reservoirs to control weeds.
- Chisel plow compacted areas and remove large rocks to develop a good seed bed.
- Ensure compaction of trench backfill to prevent settlement for mainline segments. Inspect the line after one year to check for subsidence and correct subsidence problems where these occur.
- Mound soil over the trench of small diameter pipelines (approximately six inches or less), allow a year for settlement and grade trench to match existing topography.
- Place all excavated material from streams or wetlands above the high water mark, when water is present, where possible. Where not possible, minimize the placement of soil materials in streams or wetlands.
- Employ erosion control measures where necessary to reduce wind and water erosion.
- Identify pipeline segments requiring special reclamation efforts utilizing soils map and field survey data during final design.
- Avoid placing permanent facilities on prime (important) farmland where possible. Where prime farmland is removed, a farmland conversion rating form (AD-1006) would be completed and processed through the Natural Resource Conservation Service.
- Wet construction areas during dry conditions to control dust.

8.1.2 Water Resources

- Directional bore under perennial streams. At flowing intermittent streams, directional boring would be used whenever practical. The contractor will make at least two boring attempts before using an alternative crossing method. Where it is not practical to bore, open cut through intermittent streams.[1] Initiate construction when the streams are dry whenever practical. Use standard reclamation practices to reclaim vegetation and minimize erosion.

- Place silt barriers or fabric mats on slopes where necessary to reduce movement of sediments into stream channels.

- Avoid discharges of fill material at unavoidable stream crossings, as specified under provisions of Section 404 of the Clean Water Act.

- Prevent contamination of water at construction sites from fuel spillage, lubricants, and chemicals, by following safe storage and handling procedures and North Dakota Department of Health guidelines.

- Place no structures in any floodplain that would interfere with the movement of floodwater.

8.1.3 Vegetation

- Stockpile and respread topsoil on all project areas and recover all topsoil possible, as noted in 8.1.1.

- Backfill after pipe installation.

- Disc or chisel plow re-topsoiled areas to reduce compaction created by heavy equipment and to prepare the seed bed.

- Reseed disturbed native grassland with native species; seed mix to be determined during final design. Reseed planted grassland with a seed mixture appropriate for the site.

- Control noxious weeds, as specified under state law, within pipeline corridors during and following construction.

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[1]The Impact Mitigation Assessment team would review the engineer's construction specifications for intermittent stream crossings in consultation with agencies who have jurisdiction. The Impact Mitigation Assessment team would make recommendations for specification changes to minimize impacts where necessary.

- Apply herbicides only in accordance with labeled instructions and state, federal, and local regulations.
- Work with landowners to defer grazing on newly seeded areas for a minimum of two years.
- Replace and replant trees off site at a ratio of two trees planted for each tree lost when shelterbelts, riparian woodlands, or woodland vegetation cannot be avoided.
- Control weed growth in tree plantings for three years.
- Monitor tree plantings for three years and grass plantings for one year. Where plantings do not adequately catch, replant with appropriate species.[1]

8.1.4 Wildlife

- Restore native and tame grasslands as noted in Section 8.1.3
- Replant native woodlands and shelterbelts as noted in Section 8.1.3
- Avoid sharp-tailed grouse dancing grounds from April to mid-May.
- Construct electrical power lines to any facilities associated with the proposed project according to "Suggested Practices for Raptor Protection on Power Lines - The State of the Art in 1981" (Olendorf et al. 1981) to the extent practical.

8.1.5 Fisheries

- Screen water intakes with a screen no greater than one-quarter inch (¼") to minimize fish mortality.
- Design intake structures with maximum inlet velocities of 0.5 feet per second or less.

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[1]The Impact Mitigation Assessment team would inspect tree and grass plantings to determine when it would be necessary to replant.

- Avoid construction across streams during periods of high flow and aquatic spawning.
- Maintain in-stream flows where possible during construction of stream crossings.

8.1.6 Interbasin Biota

- Pre-treat raw water from Missouri River near the intake site or the Max booster pump station with either ozone or chlorine/chloramine. A chloramine residual would be maintained in the pipeline for biofilm control.
- Monitor water quality of the raw water sources to determine seasonal changes in water quality and how that may affect disinfection strategies.
- Develop a long-term water monitoring plan to assess the effectiveness of pre-treatment in meeting the disinfection requirements of 3-log and 4-log inactivation of *Giardia* and viruses, respectively.
- Provide final design plans and construction specifications for the pre-treatment and delivery systems to the Garrison Joint Technical Committee prior to the awarding of their respective construction contracts.
- Provide a long-term operation, maintenance, and replacement plan to the Garrison Joint Technical Committee for review, prior to the system becoming operational.
- The pre-treated water reservoir and the pressure reducing valve (PRV) vault within the Hudson Bay basin incorporates isolation valves. Three additional automated isolation valves will be incorporated in the design of the pipeline within the Hudson Bay basin to reduce volumes of water released in the event of a pipeline failure. These will be located approximately at pipeline stations 2377+60, 2480+40, and 2527+20.
- Sludge resulting from the filter backwash and softening clarification processes at the Minot Water Treatment Plant will be either treated to inactivate disinfectant resistant pathogens or transported for disposal at an appropriate disposal facility. Disposal of sludge within the Minot municipal waste landfill (RCRA subtitle D landfill) is acceptable provided the sludge is placed within lined cells, covered daily with soil, and the leachate from the landfill is not discharged into a waterway within the Hudson Bay basin. Disposing of sludge leachate in the city sewage treatment system will not be allowed. Any sludge from the leachate collection system will also be placed in the lined cell at the

landfill. Landfill disposal within the Missouri River basin will be explored as an alternative. The annual monitoring, operational and maintenance report to the JTC will include information to verify compliance with this commitment.

- Provide an emergency response plan with special emphasis on potential biota transfer issues to the Garrison Joint Technical Committee, prior to the system becoming operational.

- The State of North Dakota, through the State Water Commission, will provide an annual monitoring, operation, and maintenance report to the Garrison Joint Technical Committee.

- The State of North Dakota, through the State Water Commission, will assume ultimate responsibility for the operation, maintenance, and replacement of the pre-treatment and delivery system.

- The State of North Dakota, through the State Water Commission, will implement the recommendations of the Biota Transfer Control Measures Report (Houston Engineering et al, 1998) and the Biota Transfer Control Measures Report Update (Houston Engineering and Montgomery Watson, 2001), and refinements thereof during the detailed design of the facilities, and during startup of operations.

- The State of North Dakota, through the State Health Department, will assume responsibility for Safe Drinking Water Act compliance monitoring for the raw water disinfection system.

- Permit the Garrison Joint Technical Committee, or its representatives, to inspect the system and examine the records at any time.

- The State of North Dakota, State Water Commission, and the NAWS Advisory Committee will continue to provide project updates to the U.S.-Canada Consultative Group as the project moves into final design phase.

8.1.7 Threatened and Endangered Species

- Follow the federal endangered species consultation process as required by the Endangered Species Act.

- Avoid known locations of piping plover habitat and saline lakes.

- If threatened or endangered species are encountered during construction, all ground disturbing activities in the immediate area would be stopped immediately until Reclamation can consult with the U.S. Fish and Wildlife Service to determine appropriate steps to avoid any effects to these species, including cessation of construction in the area.

8.1.8 Wetlands

- Avoid seasonal, semipermanent, and permanent wetlands where practical. When they cannot be avoided, avoid construction through seasonal, semipermanent, or permanent wetlands until after July 15th where practical.

- When large wetlands abut the road right-of-way, place pipeline in rights-of-way where possible to reduce impacts.

- Locations would be noted and recorded before construction, with assistance from state, federal, and local officials.

- Backfill would be placed in trenches to restore the impermeable layer where necessary.

- The use of diaphragms or cutoff collars would be used where soils and engineering evaluations indicate they are needed to prevent drainage of the wetland. [1]

- If possible, avoid placement of trench spoil material within wetland boundaries when wetlands are wet.

- Where existing wetlands cannot be reconstructed in their current location, create or restore wetlands on an acre per acre basis as defined by the GDU mitigation plan.

[1]The Impact Mitigation Assessment team would review the engineer's construction specifications for wetland crossings in consultation with agencies who have jurisdiction. The Impact Mitigation Assessment team would make recommendations for specification changes to minimize impacts where necessary.

8.1.9 Historic Properties

- Upon determining pipeline alignments for each phase of construction, Reclamation will use the Class I file search to consult with the SHPO per 36 CFR Part 800.4 to determine which areas would require further Class III, pedestrian cultural resources inventories in the high and medium site potential zones. These inventories would be conducted by a qualified professional archaeologist and be completed before construction of each phase begins. In addition, Reclamation would invite the appropriate tribal groups to participate in the consultation process.

- Reclamation shall consult with the appropriate Native American tribes regarding the locations of and potential impacts to properties of traditional religious and cultural importance to Native Americans. If any archaeological historic properties cannot be avoided and must be mitigated, Reclamation would invite the appropriate Native American tribes to participate in the development of an appropriate treatment plan.

- Reclamation would avoid affecting historic properties to the extent possible. Should any historic properties be located, Reclamation, in consultation with the SHPO, would determine appropriate avoidance or mitigation measures. These measures would be instituted before construction begins in compliance with the programmatic agreement between Reclamation, the Advisory Council on Historic Preservation, and the North Dakota State Historic Preservation Office for the implementation of Reclamation undertakings in North Dakota.

- Should any buildings, structures, sites, objects, or districts or properties of traditional religious and cultural importance be discovered that qualify as historic properties, Reclamation would consult with the SHPO to determine whether any qualify as historic properties and to determine the effects of construction activities on the properties per 36 CFR part 800.4 and 800.5. Any avoidance or mitigation measures would be instituted before construction begins. If unanticipated cultural resources are encountered during construction, all ground disturbing activities in the immediate area of the resource would be stopped until Reclamation can consult with the SHPO and appropriate tribes and evaluate the resource per 36 CFR Part 800.13.

8.1.10 Paleontological Resources

- Reclamation has entered into a cooperative agreement with North Dakota Geological Survey regarding paleontological resources. Under this agreement, North Dakota Geological Survey would provide Reclamation with the locations of all known fossil sites in the vicinity of pipeline corridors. All previously recorded paleontological resources and paleontologically sensitive zones within the path of the proposed project would be inspected in the field by a qualified paleontologist. Avoidance measures would then be developed to avoid significant resources. Also, Reclamation would consult with North Dakota Geological Survey about the need for paleontological survey of areas likely to contain significant fossils. Such surveys would be completed prior to project construction. Based upon survey data, Reclamation would consult with North Dakota Geological Survey about revising routes to avoid damaging significant fossil locations.

8.1.11 Social/Economic Resources

- Keep the public and local officials informed on the progress of the NAWS project through regular communication avenues.

- To the extent possible, hire local workers to reduce the influx of people and demands on community services.

8.1.12 Land Use and Ownership

- Establish ownership maps for use by all agencies.

- Contact landowners to be affected by the construction of project pipelines and facilities as soon as possible.

- Locate all utilities prior to completion of final design and notify each entity.

- Locate all gas and petroleum lines and consult with the owners about specific design precautions to be taken when crossing them.

- Consult with companies and agencies about crossing land underlain by mineable mineral deposits such as coal or gravel.

- Consult with agencies and private owners to ensure that the locations of project facilities do not conflict with current or future land use plans.

- Consult with EPA to accurately delineate the locations of any hazardous waste sites.

- Consult with landowners and agencies about specific recommendations for restoration of their lands after construction.
- Repair all fences after construction, unless otherwise agreed to by the landowner.
- Consult with state and county highway departments about the use of roadway rights-of-way as pipeline corridors and the type of crossings to be installed.
- Contact the U.S. Air Force to determine the locations of underground missile communication systems.
- Farming operations would not be interrupted once construction is completed and no permanent change of land use would occur after installation of the pipeline. Where valves would be located in cultivated areas, driveways, roads, or other high traffic areas, the valve box would be buried below the plow depth, or at a depth to clear road grader maintenance.
- Construct sewer crossings in accordance with the North Dakota State Health Department requirements.

8.1.13 Indian Trust Assets

- For any portions of the system within the Fort Berthold Reservation and crossing trust lands, right-of-way easements for the pipeline would be secured according to 25 CFR Part 169 - Rights-of-Way Over Indian Lands. In part, this would require the consent of the landowner(s), with concurrence from the Bureau of Indian Affairs.

8.1.14 Aesthetics

- Mitigate noise by installing all pumping equipment in a building.
- Conduct proper reclamation to minimize long-term scars on the land.
- Build and maintain sites used for any facilities related to the proposed project in conformance with local or county zoning and/or building requirements or restrictions. Tanks would be painted to blend-in with the locale.

- Seed pipeline rights-of-way where required in native prairie to reduce contrast between the rights-of-way and undisturbed native prairie.

8.2 Permit and Easement Requirements

8.2.1 Water Use Permits

Permits for the appropriation of water from both groundwater and surface water sources would be obtained as required by the State of North Dakota through the office of the State Engineer.

8.2.2 Sections 10 and 404 Requirements

In order for the project sponsor to construct the proposed pipeline and intake facilities, Section 10 and 404 permits must be secured for the proposed activities. The U.S. Army Corps of Engineers authority to regulate the construction comes from Section 10 of the Rivers and Harbors Act of 1899 which prohibits the obstruction or alteration of navigable waters of the United States and Section 404 of the Clean Water Act (Section 404) which prohibits the discharge of dredged or fill materials into waters of the United States.

8.2.3 Health Department Criteria

There are no permits required by the North Dakota State Health Department to construct a system similar to the ones proposed in this assessment. However, all plans and specifications for rural and municipal water supply systems must be approved by the North Dakota State Health Department prior to advertising the project for construction. In addition, all operators of the system or subsections of the system must be licensed by the North Dakota State Health Department.

North Dakota State Health Department personnel also review Section 404 permits under a cooperative agreement with the U.S. Corps of Engineers for Section 401 water quality compliance. These reviews are conducted as part of the Clean Water Act.

8.2.4 Right-of-Way Permits

The NAWS system has been laid out adjacent to major state and county highways to reduce environmental impacts, to ease system maintenance, and to reduce the disturbance of adjacent lands.

Whenever possible, the pipeline would be located on easements secured from landowners adjacent to the designated roadways. Perpetual easements would be secured for the pipeline, and temporary construction easements would be purchased to allow for construction access. The easements would detail the rights of the pipeline owner and the landowner as well as the reclamation criteria for the post-construction reclamation of the land.

Where it is not feasible to obtain private easements, the pipeline would be located along the outside edge of roadway rights-of-way. For example, if the main trunk line were constructed from Lake Audubon/Sakakawea to Minot, portions of the line may be placed in the eastern-most edge of the U.S. Highway 83 right-of-way. In order to place the pipeline in the highway right-of-way, permits would have to be secured from the North Dakota Department of Transportation. Such a permit would be secondary to highway purposes, which means that if the pipeline had to be moved to facilitate highway construction, it would be moved at the owner's expense. Easements to use county and township roadway rights-of-way could be obtained in the same manner as North Dakota Department of Transportation easements.

When pipelines are located within highway easements, all appurtenant structures would conform to the safety criteria specified by the highway authority.

Appropriate permits must also be obtained from the U.S. Air Force for communication cables, and the U.S. Fish and Wildlife Service to cross fee and easement lands.

An easement must be obtained from the U.S. Army Corps of Engineers to construct the intake facility on Corps property.

8.2.5 Other

Zoning

- Zoning clearances may be issued as needed for system facilities.
- Building permits may be required for certain structures, depending on location and local ordinances.

Municipalities

- Easement agreements and building permits may be required.

Utilities

- Easements or agreements must be obtained for construction in rights-of-way for railroads, pipelines, and other facilities.

Private

- Easement agreements would be negotiated with private landowners.

Trust and Allotted Land

- Easements must be obtained to cross Tribal Trust and Allotted lands.

8.3 Compliance with Environmental Statutes

The NAWS project would comply with the following state, federal, county, township, and city statutes, ordinances, and zoning regulations. All permits and approvals would be secured prior to the beginning of construction.

8.3.1 Federal

American Indian Religious Freedom Act of 1978 (P.L. 95-341) and Religious Freedom Restoration Act of 1993 (42 U.S.C. 2000)

The American Indian Religious Freedom Act requires federal agencies to consider the impacts of projects on the ability of American Indians to continue their traditional cultural and religious practices. The Religious Freedom Restoration Act protects everyone's practice of religion and establishes tests that must be met before a federal agency can "substantially burden a person's exercise of religion."

Archaeological Resources Protection Act of 1979 (P.L. 96-95)

Permit required to remove archaeological resources from federal or Indian lands. Permits may be issued to educational or scientific institutions, only if the removal would increase knowledge about archaeological resources.

Archaeological and Historic Preservation Act of 1974 (P.L. 93-291)

Authorizes federal agencies to protect cultural resources.

Clean Air Act (42 U.S.C. 7401) and Amendments of 1970

Authorizes establishment and enforcement of primary and secondary air emission standards.

Clean Water Act (33 U.S.C. 1251 et seq.)

Regulates the discharge of pollutants or fill into waters of the United States. National Pollutant Discharge Elimination System (NPDES) permit is required for point-source discharges (Section 402). Permit required for placement of material into waters of the United States and jurisdictional wetlands (Section 404).

Endangered Species Act of 1973 (P.L. 93-205)

Requires federal agencies to ensure that federally authorized activities do not have adverse impacts on threatened or endangered species or their critical habitats.

Executive Order 11988 (Floodplain Management, 1977)

Requires federal agencies from siting developments on floodplains when practicable alternatives exist. If a facility is sited on a floodplain, action shall be taken to minimize potential harm to or within the floodplain.

Executive Order 11990 (Protection of Wetlands, 1977)

Requires federal agencies to avoid siting facilities in wetlands wherever there is a practicable alternative.

Executive Order 12898 (Environmental Justice, 1994)

Requires that each federal agency analyze the environmental effects, including human health, economic, and social effects, of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by the National Environmental Policy Act. It also requires that each Federal agency shall provide opportunities for community input in the NEPA process; identify potential effects and mitigation measures in consultation with affected communities; and improve the accessibility of meetings, crucial documents, and notices.

No environmental justice issues were identified during scoping or project planning. No environmental or health hazards have been imposed on the communities or areas where NAWS proposes to develop facilities. Selection of sites and alternatives have been primarily on water availability and design criteria. Implementation of the NAWS project would not exclude, either by intention or design, any minority or low-income populations within the project area from benefits associated with the action. Additionally, a decision to implement the NAWS project would not subject any minority or low-income populations to a disproportionate share of environmental or health risks or an inequitable share of project costs.

Executive Order 13007

Issued May 24, 1996, the President directed federal agencies to accommodate Indian tribes requirements for access to and ceremonial use of sacred sites on public lands and to avoid damaging the physical integrity of such sites.

Farmland Protection Policy Act of 1995 (P.L.97-98)

Requires that federal agencies assess impacts of important farmland in the development of federal projects. Requires federal agencies to consider alternative actions that could lessen adverse effects and to ensure that their actions are compatible with state and local government and private programs to protect farmland.

Fish and Wildlife Coordination Act of 1958 (P.L. 85-624)

Mandates that fish and wildlife shall receive equal consideration with other aspects of water resources development, operation, and maintenance. The U.S. Fish and Wildlife Service and the state agency having jurisdiction over fish and wildlife resources within the state must be consulted to prevent loss of or damage to fish and wildlife resources. Also requires construction to provide appropriate means to avoid or replace losses to these resources or their habitats.

National Environmental Policy Act (P.L. 91-190)

Ensures that federal actions assess and disclose environmental and human health impacts before final design, construction, or implementation of federally funded or approved projects.

National Historic Preservation Act of 1966 (P.L. 89-665), as amended through 1992 (Public Law 102-575)

The National Historic Preservation Act (NHPA) establishes the federal policy concerning the protection of historic properties. Federal agencies are required to carry out all activities under the National Historic Preservation Act in cooperation with state, Three Affiliated Tribes and local governments. The act designates the State Historic Preservation Officer as the responsible entity in each state for administering programs under National Historic Preservation Act. The act also creates the Advisory Council on Historic Preservation to serve as the advisory body to the Executive Branch on historic preservation issues. Section 106 of the act requires federal agencies to consider the effects of their undertakings on historic resources and to give State Historic Preservation Officer and the Advisory Council reasonable opportunity to comment on the effects of those undertakings. Finally, the 1992 amendments require the federal agency to consider the impacts of undertakings on properties of traditional religious and cultural importance to American Indians and to involve American Indian tribes to participate in the consultation process, should such resources be affected.

Native American Graves Protection and Repatriation Act (P.L. 101-601)

The Native American Graves Protection and Repatriation Act establishes Federal policy with respect to Native American burials and graves located on federal or Indian lands. Federal agencies are required to consult with and to obtain the concurrence of the appropriate tribes with respect to activities that may result in the disturbance and/or removal of such burials and graves on federal or reservation lands.

Safe Drinking Water Act (P.L. 99-339)

The Safe Water Drinking Act, originally enacted in 1974, gave the federal government, through the Environmental Protection Agency, the authority to set standards for drinking water quality in water delivered by community (public) water suppliers. The Environmental Protection Agency has established several regulations that apply to water treatment plants and distribution systems. Detailed information about the Safe Drinking Water Act, as it relates to NAWS, can be found in the *Summary of Safe Drinking Water Act Existing and Proposed Standards* [Houston Engineering et al. 1993a].

8.3.2 State

Approval of Engineering Plans for Water Facility

The North Dakota State Health Department must approve engineering plans and specifications for drinking water systems to ensure compliance with drinking water regulations for public water supply systems.

Certification of Water Facility Operators

Water plant operators must pass an examination and meet minimum experience and education requirements. Water treatment plants serving a population of 500 or more must be operated under the supervision of someone certified by the North Dakota State Health Department.

Permit to Appropriate Water

A water permit must be obtained from the State Engineer to appropriate water for domestic and other uses.

Protection of Human Burial Sites, Human Remains, and Burial Goods (NDCC 23-06-27)

If human remains or burial goods are discovered during project construction, any human remains or burial goods would be dealt with in accordance with the Native American Graves Protection and Repatriation Act and/or state law. North Dakota Century Code 23-06-27 - Protection of Human Burial Sites, Human Remains, and Burial Goods - protects human burial sites and burial goods on private lands or on state and political subdivision lands in North Dakota.

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Appendix A.

Appendix A.

Alternatives originally formulated for the NAWS project [Houston Engineering et al. 1988b].

East Water Supply System - Base Plan

The service area of this system includes the northern part of McLean County, most of Ward County, and all of McHenry, Renville, and Bottineau Counties. The major users on this system would include Minot (which also serves the Air Force Base and North Prairie Rural Water); Upper Souris and All Seasons Rural Water Districts, the larger cities of Garrison, Kenmare, Mohall, and Bottineau; portions of the Fort Berthold Indian Reservation, including White Shield; and several smaller cities not presently served by rural water. Flows for future rural water systems have been included in the system. The design population to be served by this system is 88,627, of which 67,816 are city residents and 20,811 rural. Elevations range from a lake elevation of 1,850 feet msl to a summit of 2,235 feet msl north of the City of Max, and to a low of 1,415 feet msl where the pipeline would cross the Souris River west of Bottineau.

Components of this system alternative would include an intake at Lake Audubon and a 30 million gallon per day (mgd) conventional water treatment plant located near the water source at Lake Audubon. Approximately 415 miles of pipeline (ranging from 4" to 42" in diameter), ten pumping stations, three pressure-reducing stations, an ozonation facility and a microstraining facility would be required to serve the area. Storage would be provided in conjunction with the pumping stations and treatment plant.

The East Water Supply System would provide treated water throughout the system and additional water treatment plants would not be necessary unless softened water is desired. The City of Minot could continue to soften their water as they presently do.

East Water Supply System - Alternative N° 1

The service area of this system would be the same as the East Water Supply System, serving the same users (67,816 city and 20,811 rural, for a total of 88,627). The main difference in Alternative No. 1 is the location of the treatment facility. This system would have an intake structure with high service pumps at Lake Audubon. The water would not be treated at lakeside but would be microstrained at the first pump station and would also be ozonated at the reservoir for interbasin biota transfer control. The water would then flow towards Minot to the Minot Treatment Plant. The Minot Treatment Plant would be expanded to treat all the water that would run southeast, east, west, and north from Minot in addition to the City of Minot's water. A new water treatment plant would also be constructed at Garrison, since Garrison would be receiving raw water. Garrison would have an option of constructing a conventional treatment plant or a water-softening treatment plant. This plant would treat water for the cities of Garrison and White Shield as well as the rural communities in this area. In this alternative, all water flowing beyond the Minot area would have to be treated to the same level of treatment that Minot has. At the present time Minot is softening its water.

Elevations in this system are the same as the East Water Supply System. Approximately 419 miles of pipeline (ranging from 4" to 42" in size), ten pumping stations, plus high service intake pumps and two pressure-reducing stations would be required to serve the area. In comparison to the East Water Supply System, Alternative N° 1 would have four additional miles of pipeline, one additional pumping station, and one less pressure-reducing station. Storage would be provided in conjunction with the pumping stations. Sub-alternatives (Alternatives N° 2 and N° 3) of this alternative could service the same areas as described in the East Water Supply System - Base Plan.

Since 1988, Garrison has constructed a Lake Sakakawea intake as well as a treatment plant. White Shield is in the process of developing an intake on Lake Sakakawea and a treatment plant.

East Water Supply System - Alternative N° 2

The service area of this system is the same as the East Water Supply System with the addition of most of Mountrail County. Additional major users would be the larger communities of New Town and Stanley, the remaining portion of the Fort Berthold Indian Reservation, plus the smaller communities of Ross, Plaza, Makoti, and Ryder. Flows for future rural water in Mountrail County would also be included in the system. The design population to be served on this system is 96,787, of which 73,317 are city residents and 23,470 are rural. The City of Parshall is in the service area but is not included in this alternative since the city already has a small intake into Lake Sakakawea and has its own treatment plant, both of which are quite new and producing good quality water.

Elevations in this system would be the same as the East Water Supply System with the addition of one more summit south of the City of Stanley peaking at 2,370 feet msl. Approximately 512 miles of pipeline (ranging from 4" to 42" in size), 13 pumping stations, and three pressure-reducing stations would be required to serve the area. In comparison to the East Water Supply System, 97 additional miles of pipeline and three additional pumping stations would be required. The intake structure, treatment plant, and storage would be at Lake Audubon as previously described but would be slightly larger in size.

This alternative could also have two treatment points as discussed in the East Water Supply System Alternative N° 1 in which water would be treated at Minot and Garrison.

Alternative N° 2 was not selected because it would be more cost effective to serve the New Town area from the existing Parshall plant and Stanley from the expanded Ray/Tioga system.

East Water Supply System - Alternative N° 3

The service area of this system includes all communities described in the East Water Supply System plus that area described in Alternative N° 2 (which adds cities and rural water in Mountrail County), plus Divide County, Burke County, and the northern portion of Williams County. Major additional users would include New Town and Stanley as described in Alternative N° 2, plus the larger cities of Bowbells, Crosby, Columbus, Grenora, Powers Lake, and several smaller cities located along N.D. State Highways N° 5 and N° 50. The design population to be served on this system is 106,537, of which 78,426 are city residents and 28,111 are rural. The intake and treatment capabilities would be increased to 33 million gallons per day. The system would also provide water to the proposed Writing Rock Rural Water system located in the very northwest corner of the state.

A new summit elevation would be 2,470 feet msl located east of Powers Lake. This system would have approximately 701 miles of pipeline (ranging from 4" to 48" in size), 19 pumping stations and four pressure-reducing stations. As compared to the original system, this alternative has 286 more miles of pipeline, nine more pumping stations, and one more pressure-reducing station. Intake treatment and storage would be at Lake Audubon, similar to the East Water Supply System, but with greater capacity.

This system was dubbed the "highline route" and was not selected for economic reasons. The NAWS Advisory Board, North Dakota State Water Commission, and consultants determined the western area would be better served from the Williston treatment plant.

West Water Supply System - Base Plan

The service area of this system includes Williams, Divide, and Burke Counties. This system would use the City of Williston's existing intake from the Missouri River located southwest of the City of Williston, and the City of Williston's water treatment plant located near the intake. The required intake and treatment capacity for this system would be 14.0 mgd, of which 10 mgd would be for the City of Williston. The existing intake is of adequate size; however, the current capacity of the water treatment plant is only 7 million gallons per day. The plant would therefore have to be expanded to double its present capacity.

The major users on this system include Williston, which also serves Williams Rural Water Association, plus the larger towns of Grenora, Powers Lake, Crosby, Columbus, and Bowbells. Several smaller cities within the area, along with the proposed Writing Rock Rural Water System, would also be served. The design population to be served by this system is 34,160, of which 24,684 are city residents and 9,475 are rural.

Elevations in this system range from Williston's water treatment plant at 1,880 feet msl to a summit of 2,420 feet msl west of the City of Ray. The intake-treatment plant area is the lowest elevation within the system. Approximately 231 miles of pipeline (ranging from 4" to 16" in size), 7 pumping stations, and one pressure-reducing station would be required to serve the area. Storage would be provided in conjunction with the pumping stations and treatment plant. The West Water Supply System would have treated water available throughout the system, and no additional water treatment plants would be necessary. Unless the City of Williston decided to discontinue softening, all the water in this system would be softened.

West Water Supply System - Alternative N° 1

The service area of this system includes Divide County, Burke County, and only the northern part of Williams County. The cities of Ray and Tioga would not be served by this alternative. The cost of expanding the Williston treatment plant to 10 mgd to meet future water requirements of the city and the Williams Rural Water System has been included. Other than for Williston and Williams Rural Water System, this system would utilize a groundwater source. A 2.4 mgd well field and treatment plant would be developed in the Grenora Aquifer in the Grenora area. The treatment would involve iron and manganese removal followed by electrodialysis for the reduction of sulfates, sodium, and TDS.

Major users on this system would include Grenora, Powers Lake, Crosby, Columbus, and Bowbells, plus several smaller cities within the area. The design population to be served on this system is 28,385, of which 21,144 are city residents and 7,241 are rural. Flows for the proposed Writing Rock Rural Water System have been included in the system design. Elevations in this system range from a water source elevation of 2,100 feet msl to a summit of 2,375 feet msl located near Wildrose to a low of 1,910 feet msl at Bowbells. Approximately 177 miles of pipeline (ranging from 4" to 14" in size), five pumping stations, and one pressure-reducing station would be required to serve the area. Storage would be provided in conjunction with the pumping stations and treatment plant. This system would provide treated water throughout the system and no additional water treatment plants would be necessary.

It was determined the Grenora Aquifer would not provide a reliable long-term source of water for these northwestern communities. During the 1988 to 1992 drought years the Grenora Aquifer experienced significant drawdown.

West Water Supply System - Alternative N° 2

The service area of this system would be the same as the West Alternative N° 1 plus the addition of supplying water to the existing Ray and Tioga Water System, which currently serves the cities of Ray and Tioga. The well field and treatment capacity would be increased from 2.4 million to 3.6 million gallons per day. The design population to be served on this system is 32,768, of which 24,119 are city residents and 8,649 are rural. Elevations would be the same as Alternative N° 1, except there is an additional summit to be crossed north of Ray which has an elevation of 2,430 feet msl. Approximately 194 miles of pipeline (ranging from 4" to 16" in size), five pumping stations and one pressure-reducing station would be required. Alternative N° 2 has 17 more miles of pipe than Alternative N° 1. It has the same number of pumping stations and pressure-reducing stations. Storage and treatment would also be the same.

This alternative was also rejected because of the unreliability of the Grenora Aquifer.

Parshall System

The service area of this system includes the southeastern part of Mountrail County, including a portion of the Fort Berthold Indian Reservation, and the southwestern portion of Ward County. This system would utilize the City of Parshall's existing intake and water softening plant which were built in the mid-1980s. The intake is located approximately 10 miles southwest of Parshall in the VanHook Arm area of Lake Sakakawea. The major users on this system would include the small communities of Plaza, Makoti, and Ryder, along with continued service to Parshall. Flows for the future Mountrail Rural Water System have been included in this system. The design population to be served on this system is 2,810, of which 1,681 are city residents and 1,129 are rural.

Elevations in this system range from Parshall's existing groundwater storage tank located on the northeast side of Parshall at elevation 1,950 feet msl to a summit of 2,120 feet msl north of Ryder. The source of water is the lowest point of this system. Approximately 30 miles of pipeline (ranging from 4" to 10" in size) and one pumping stations would be required to serve the area. Storage would be provided in conjunction with the pumping station. Maximum day flows in this system would be 0.8 mgd; therefore, Parshall's water treatment plant which has a current capacity of 0.4 mgd would be expanded to twice its present capacity.

Parshall's intake is constructed at an elevation of 1,812.5 feet msl. If or when the level of Lake Sakakawea should drop near or to this level, the intake would not be usable. If this were to occur, it would become necessary to lower the intake.

The Parshall System has evolved into a key element of the NAWS project because of its location and ability to economically serve a somewhat isolated population center. When Stanley decided to join the Ray/Tioga water system, the City of New Town was added to the Parshall system, bringing the total population served to 4,198, of which 3,069 are city residents and 1,129 are rural. It has proven more economical to upgrade the Parshall intake and treatment plant than to bring a line from the East Water Supply System.

New Town-Stanley System

The service area of this smaller system would be the central and western portions of Mountrail County, including a portion of the Fort Berthold Indian Reservation. This system would have an intake into Lake Sakakawea west of New Town near the Four Bears Memorial Bridge, and would have a 1.4 mgd treatment plant located near New Town. The major users on this system would be New Town and Stanley plus the small community of Ross. It would also provide service to the proposed Mountrail County Rural Water Users District. The design population to be served on this system is 5,128, of which 3,598 are city residents and 1,530 are rural.

Elevations in this system range from a lake elevation of 1,850 feet msl to a summit of 2,370 feet msl south of Stanley. Approximately 42 miles of pipeline (ranging from 4" to 12" in size) and three pumping stations would be required to serve the area. Storage would be provided in conjunction with the pumping stations and treatment plant. The New Town-Stanley system would have treated water available throughout the system and additional water treatment plants would not be necessary. If softened water was desirable, a lime-softening treatment plant could be constructed rather than a conventional treatment plant, but this would result in higher operation and maintenance costs.

Since the intake for the City of Parshall has a limited range to draw water from Lake Sakakawea, the New Town-Stanley system could be extended to serve the Parshall area. To do this, the New Town-Stanley water treatment plant would be increased to a capacity of 2.2 mgd, the 12" diameter pipeline would be changed to a 14" pipeline, and an additional 10 miles of 12" pipeline would be constructed to Parshall. Estimated costs for these added facilities are included with the New Town-Stanley cost estimates.

The City of Stanley has joined the Ray/Tioga system and now has a good water supply; therefore, this is not a viable option.

Ray/Tioga/Stanley System

The service area of this system includes the east central portion of Williams County and the west central portion of Mountrail County. This system would utilize an existing well field and water softening treatment plant located east of Ray, which now serves the cities of Ray and Tioga. The system would utilize the existing groundwater source which is the Ray Aquifer. Additional wells and treatment capacity would be needed to provide 2.1 mgd, of which approximately 1 mgd would be for the new service area. The major users on this system would be Stanley in addition to the existing cities of Ray and Tioga. The small city of Ross would be served and flows for future rural water service in the area have also been included into the design. The design population to be served on this system is 7,475, of which 4,996 are city residents and 2,479 are rural.

Elevations in this system range from a water source elevation of 2,229 feet msl to a summit of 2,455 feet msl located southwest of Tioga. Approximately 34 miles of pipeline (ranging from 10" to 12" in size) would be required to serve the area. The existing 6" and 10" line serving Ray and Tioga would be left in place and utilized. Approximately 12 miles of the existing 10" line would be paralleled with new pipeline since the existing line is not large enough to carry the flows of Stanley, Ross, and future rural water demands. Storage would be constructed at the summit southwest of Tioga. The existing treatment plant and well field would be expanded. No additional pumping stations would be required; however, the existing high service pumps in the treatment plant would be replaced with larger pumps.

As stated previously, the City of Stanley has joined the Ray/Tioga system to formally create the Ray/Tioga/Stanley System. The West Water Supply System has the capability to serve this combined system.

These alternatives were reviewed between 1988 and 1995 by the general public, the NAWS Advisory Committee, and the North Dakota State Water Commission. In 1995, the *Pre-Final Design Report* [Houston Engineering et al. 1995a] presented the results of these seven years of study and reevaluation, and delineated three alternative water delivery systems: the West System, the Parshall System, and the East System. A brief description of these 1995 systems follows from the 1995 report.

West System

The service area for the West System includes all of Williams, Divide, and Burke Counties and a portion of Mountrail County. This system would use the City of Williston's intake structure on the Missouri River and its existing water treatment plant. The required intake and treatment capacity for this system would be 13 million gallons per day (mgd). Nine mgd would supply major users like the City of Williston, the Ray & Tioga Water Association, and the Williams Rural Water Association. Four mgd would supply other communities and rural users in the service area including Grenora, Powers Lake, Crosby, Stanley, Columbus, and Bowbells. Several smaller cities and towns within the area would also be served along with the proposed Writing Rock Rural Water Association. The design population of the West System is approximately 27,000 people, of which 21,100 are city residents and 5,900 reside in rural areas. Approximately 220 miles of pipeline ranging in diameter from 4" to 16 ", ten finished-water pumping stations, and five reservoirs would be required to serve the system.

Parshall System

The required intake and treatment capacity for this system would be 1.5 mgd with 1 mgd allotted to supply Parshall, New Town, Makoti, and Plaza, and 0.5 mgd to supply other users including the proposed Mountrail Rural Water System. The design population of the Parshall System is about 4,700 people of which about 2,800 reside in the four towns and 1,900 reside in rural areas. Construction of approximately 38 miles of pipeline (ranging from 4" to 10"), one pumping station (at the expanded water treatment plant), and one reservoir would be required to serve the system.

East System

The service area of the East System includes: the northern portion of McLean County; all of Pierce, McHenry, Renville, and Bottineau Counties; and the eastern two-thirds of Ward County. The major users would include: Minot (which also serves the Minot Air Force Base and a portion of the North Prairie Rural Water System), Kenmare, Rugby, and Bottineau; the existing rural water systems of the Upper Souris and All Seasons Rural Water Associations; and the three proposed rural water systems, one around Lake Metigoshe, one in Pierce County, and one in the northern extension of the McLean-Sheridan System. The design population for the East System is approximately 80,300 people, of which about 60,900 are city residents and 19,400 reside in rural areas. The maximum design capacity of the East System is about 28 mgd.

The East System would include 457 miles of pipeline (ranging from 4" to 44"), a new intake at Lake Audubon, a raw-water pumping station, a raw-water storage reservoir, expansion and upgrade of the Minot water treatment plant, 14 finished-water pumping stations, and 13 finished-water reservoirs.

Appendix B.

Appendix B.

Letter from the North Dakota Department of Health about disinfection credits under the Surface Water Treatment Rule.

NORTH DAKOTA
DEPARTMENT OF HEALTH

ENVIRONMENTAL HEALTH SECTION

1200 Missouri Avenue
P.O. Box 5520
Bismarck, North Dakota 58506-5520
Fax #701-328-5200

May 16, 1997

James Lennington, Water Resources Engineer
North Dakota State Water Commission
900 East Boulevard
Bismarck, ND 58505-0850

RE: Northwest Area Water Supply Project (NAWS)

Dear Jim:

This letter is written at your request to discuss the use of raw water disinfection to satisfy the inactivation requirements under the Surface Water Treatment Rule (SWTR) for the NAWS project.

The present SWTR does not preclude the possibility of raw water disinfection to meet the inactivation requirements. However, it appears that the pending Disinfectants/Disinfection Byproducts (D/DBP) Rule may disallow inactivation credit for disinfection prior to the sedimentation process unless certain criteria are met. If these criteria can be met, we will allow such credit for the NAWS project and the city of Minot given the high quality of the proposed raw water source (Lake Sakakawea or Audubon). The criteria are:

1. At least <u>one</u> of the following requirements must be met:

   a. The finished water total organic carbon (TOC) level must be less than 2.0 mg/l, calculated quarterly as a running annual average.

   b. The raw water, calculated quarterly as a running annual average, must contain less than 4.0 mg/l TOC and an alkalinity greater than 60 mg/l. In addition, the total trihalomethane and haloacetic acid concentrations in the finished water (calculated as above) must not exceed 40 and 30 ug/l (possibly 20 and 15 ug/l under stage 2), respectively, with any disinfectant.

   c. If chlorine is used for disinfection, the finished water total trihalomethane and haloacetic acid concentrations, calculated quarterly as a running annual average, must not exceed 40 and 30 ug/l (possibly 20 and 15 ug/l under stage 2), respectively.

d. The precipitative softening process must be capable of removing at least 10 mg/l of magnesium hardness (as calcium carbonate), calculated quarterly as a running annual average.

The city of Minot is presently meeting requirement D. It is assumed that requirement D will continue to be met if Lake Sakakawea or Audubon are used as the raw water source.

Requirement A appears to be the next least resource-intensive to demonstrate. Please note that the TOC, total trihalomethane, and total haloacetic acid levels to be met may be revised as a result of the ongoing Information Collection Rule and future health effects research.

2. The finished water must meet all applicable maximum contaminant levels (MCLs) established under the pending D/DBP Rule. The MCLs that may be proposed are:

Total trihalomethanes - 80 ug/l (40 ug/l under stage 2)
Total haloacetic acids - 60 ug/l (30 ug/l under stage 2)
Bromate - 10 ug/l
Chlorite - 1.0 mg/l

If the above criteria remain valid, are met, and raw water disinfection alone is capable of satisfying inactivation requirements, post-disinfection treatment would be limited to that necessary to ensure a point-of-entry (i.e., leaving the water treatment plant) residual disinfectant concentration of at least 0.2 mg/l and a detectable residual at all approved routine bacteriological monitoring sites within the water distribution system.

I hope that this information clarifies the criteria that must be met for the NAWS project if raw water disinfection alone is proposed to satisfy microbial inactivation requirements under the SWTR. Please be reminded that the pending D/DBP Rule, the pending Enhanced SWTR, and the Information Collection Rule may significantly alter or even preclude credit for raw water disinfection.

Please contact me at 328-5225 if you have any questions concerning this matter.

Sincerely,

D. Wayne Kern

D. Wayne Kern, P.E.
Drinking Water Program Manager
Division of Municipal Facilities

DWK:db
cc: Byron Thronson, Water Treatment Plant Superintendent, City of Minot
Jack Long, NDDH
Chuck Abel, NDDH
John Homelvig, NDDH

Appendix C.

Appendix C.

Annex B to the *1989 Agreement Between the United States and Canada for Water Supply and Flood Control in the Souris River Basin.*

ANNEX B

1. The Province of Saskatchewan shall have the right to divert, store, and use waters which originate in the Saskatchewan portion of the Souris River Basin, provided that such diversion, storage, and use shall not diminish the annual flow of the river at the Sherwood Crossing more than 50 percent of that which would have occurred in a state of nature, as calculated by the Board. For the benefit of riparian users of water between the Sherwood Crossing and the upstream end of Lake Darling, the Province of Saskatchewan shall, so far as is practicable, regulate its diversions, storage, and uses in such a manner that the flow in the Souris River channel at the Sherwood Crossing shall not be less than 0.113 cubic meters per second (4 cubic feet per second) when that much flow would have occurred under the conditions of water use development prevailing in the Saskatchewan portion of the Souris River Basin prior to construction of the Boundary Dam, Rafferty Dam and Alameda Dam.

(a) Under certain conditions, a portion of the North Dakota share will be in the form of evaporation from Rafferty and Alameda Reservoirs. During years when these conditions occur, the minimum amount of flow actually passed to North Dakota will be 40 percent of the natural flow at the Sherwood Crossing. This lesser amount is in recognition of Saskatchewan's operation of Rafferty Dam and Alameda Dam for flood control.

The following rules determine the percentage of the natural flow at Sherwood Crossing which is to be passed to North Dakota:

i. If the level of Lake Darling is below an elevation of 485.24 meters (1592.0 feet) on October 1 in any calendar year, Saskatchewan will pass 50 percent of the natural flow at Sherwood Crossing in that year and in succeeding years until the level of Lake Darling is above an elevation of 485.55 meters (1593.0 feet) on October 1.

ii. If the natural flow at the Sherwood Crossing is equal to or less than 24,670 cubic decameters (20,000 acre-feet) prior to October 1 of that year, then Saskatchewan will pass 50 percent of the natural flow to North Dakota in that calendar year.

iii. If the conditions specified in subparagraphs 1(a)(i) and 1(a)(ii) do not apply, then Saskatchewan will pass at least 40 percent of the natural flow at the Sherwood Crossing to North Dakota.

(b) Flow releases to the United States should occur (except in flood years) in the pattern which would have occurred in a state of nature. To the extent possible and in consideration of potential channel losses and operating efficiencies, releases from the Canadian dams will be scheduled to coincide with periods of beneficial use in North Dakota. Normally, the period of beneficial use in North Dakota coincides with the timing of the natural hydrograph, and that timing should be a guide to releases of the United States portion of the natural flow. The flow release to the United States may be delayed when the State of North Dakota determines and notifies Saskatchewan through the Board that the release would not be of benefit to the State at that time. The delayed release may be retained for use in Saskatchewan, notwithstanding the minimum release limits, unless it is called for by the State of North Dakota through the Board before October 1 of each year. The delayed release shall be measured at the point of release and the delivery at Sherwood Crossing shall not be less than the delayed release minus the conveyance losses that would have occurred under natural conditions between the point of release and the Sherwood Crossing. A determination of the annual apportionment balance shall be made by the Board on or about October 1, of each year. Any shortfall that exists as of that date shall be delivered by Saskatchewan prior to December 31, if North Dakota requests the delivery.

Appendix D.

Appendix D.

Fish species known to occur within the Missouri River basin; the Souris River of North Dakota; and the Hudson Bay drainage, as indicated by presence in Lake Winnipeg South Basin [Ryckman 1981 and International Garrison Diversion Study Board 1976].

Table D1. Fish species present in Missouri River, Souris Rive and Lake Winnipeg.

Legend:
X - Species occurrence
Q - Species occurrence questionable or poorly documented

Common Name	Missouri River Lake Sakakawea	Souris River North Dakota	Lake Winnipeg South Basin
Chestnut lamprey	Q	Q	X
Silver lamprey			X
Lake sturgeon			X
Pallid sturgeon	X		
Shovelnose sturgeon	X		
Paddlefish	X		
Shortnose gar	X		
Goldeye	X	Q	X
Mooneye			X
Lake herring			X
Blackfin cisco			X
Shortjaw cisco			X

Common Name	Missouri River Lake Sakakawea	Souris River North Dakota	Lake Winnipeg South Basin
Lake whitefish	X		X
Coho salmon	X		
Chinook salmon	X		
Rainbow trout	X		X
Brown trout	X		
Lake trout	X		X
Rainbow smelt	X		X
Central mudminnow		Q	X
Northern pike	X	X	X
Sicklefin chub	X		
Sturgeon chub	X		
Lake chub	Q	Q	X
Common carp	X		X
Brassy minnow	X	X	
Silvery minnow	X		
Flathead chub	X	Q	X
Hornyhead chub		Q	
Golden shiner	X	X	X
Emerald shiner	X	X	X

Common Name	Missouri River Lake Sakakawea	Souris River North Dakota	Lake Winnipeg South Basin
Common shiner		X	
Bigmouth shiner		X	
Blacknose shiner			X
Spottail shiner	X	Q	X
Red shiner	Q		
Sand shiner	Q	Q	X
Mimic shiner			X
Bluntnose minnow		Q	
Fathead minnow	X	X	X
Blacknose dace		X	X
Longnose dace		X	X
Creek chub	X	X	X
Pearl dace	Q	Q	X
Northern redbelly dace		Q	
River carpsucker	X	Q	
Quillback	Q		X
Longnose sucker	X	Q	X
White sucker	X	X	X
Blue sucker	X		

Common Name	Missouri River Lake Sakakawea	Souris River North Dakota	Lake Winnipeg South Basin
Smallmouth buffalo	X		X
Bigmouth buffalo	X		
Shorthead redhorse	X	Q	X
Silver redhorse		Q	X
Black bullhead	X	X	
Brown bullhead		Q	X
Channel catfish	X		X
Stonecat	X		
Tadpole madtom	Q	X	X
Burbot	X	Q	X
Brook stickleback	Q	X	X
Plains minnow	X		
Ninespine stickleback			X
Trout-perch		X	X
White bass	X	X	X
Rock bass			X
Pumpkinseed		X	
Orangespotted sunfish	X		
Bluegill	X		

Common Name	Missouri River Lake Sakakawea	Souris River North Dakota	Lake Winnipeg South Basin
Smallmouth bass	X	X	X
White crappie	X	Q	
Black crappie	X	Q	X
Yellow perch	X	X	X
Blackside darter		Q	X
Iowa darter	X	X	X
Johnny darter	Q	X	X
River darter			X
Logperch			X
Sauger	X	Q	X
Walleye	X	X	X
Freshwater drum	X		X
Mottled sculpin			X
Slimy sculpin			X
Spoonhead sculpin			X
Black buffalo	Q		

Appendix E.

Appendix E.

Perennial and intermittent stream crossings by pipeline segment, as determined by counting crossings on county highway maps.

Table E1. Intermittent and perennial stream crossings along the NAWS pipeline route.

Segment Number	Counties Included	Stream Crossings Intermittent	Stream Crossings Perennial
1	McLean, Ward	9	0
2	Ward, Renville, Bottineau	13	1
3	Bottineau	10	1
4	Bottineau	2	0
5	Bottineau	1	0
6	Bottineau	3	0
7	Bottineau	3	0
8	Renville	2	0
9	Renville, Ward, Burke	8	2
10	Burke, Divide	22	0
11	Divide	11	0
12	Williams	13	0
13	Ward	27	0
14	Ward, Mountrail	14	0
15	Bottineau	9	0
TOTAL		**147**	**4**

Streams were classified as intermittent or perennial. They were considered intermittent if they flow mostly during spring runoff and after rainfalls. Perennial streams flow year round, although not always during winter months or severe drought.

These numbers represent stream crossings found on one side of the road and should be considered estimates, since the number of streams crossed by the pipeline would vary depending on which side of the roadway is chosen for construction. The pipeline route was assumed to closely follow the existing roadways so all streams that either approached or passed under the roadway were counted and given a designation of intermittent or perennial.

Appendix F.

Appendix F.

Letter from Russell Mason Sr., Tribal Chairman of Three Affiliated Tribes, to the Bureau of Reclamation regarding the protection of purple coneflower within reservation boundaries.

MANDAN, HIDATSA, & ARIKARA NATION
Three Affiliated Tribes • Fort Berthold Indian Reservation
HC3 Box 2 • New Town, North Dakota 58763-9402

TRIBAL BUSINESS COUNCIL
701-627-4781
Fax 701-627-3805

SEP 1996 RECEIVED

Code	Initials	Date
100		
600		
617		
619		
612		

No Reply Necessary

Ms. Theresa Olson
Bureau of Reclamation
P.O. Box 1017
Bismarck, North Dakota
58501

August 27,1996

Dear Ms. Olson,

This letter is written to address concerns generated from Tribal Resolution 96-169-DSB. Let me assure the Bureau of Reclamation that this particular resolution was developed to curb the selling, and digging of the plant "purple cone flower", which is a traditional medicine that only certain tribal members have the traditional right to use and dig. Over the past two to three years non-tribal members have been coming on to the Reservation and digging the plant and selling the root to pharmaceutical companies. Due to excessive complaints from land owners and traditional people, resolution 96-169-DSB was enacted. The resolution is in no way intended to halt development of important projects such as the MR & I project. As a matter of fact the need for good quality water is essential for the people who live on Ft. Berthold.

The Tribal Business Council has worked through many complex problems and issues from the out set of the MR & I project with the Bureau of Reclamation. Our goal still remains the same and that is to distribute good quality water to the communities of the Fort Berthold Indian reservation.

We also understand the significance of protecting our cultural and traditional religious properties, along with our ancestral remains and associated grave goods from desecration. However, Let me assure the Bureau of Reclamation that resolution # 96-169-DSB, is in reference to the digging of the Purple Cone Flower plant within the reservation boundary. If additional information is needed please call either Elgin Crows Breast at 627-4399 or Edward Lone Fight at 627-3023, or contact me directly at 627-4781. Your cooperation on this matter will be greatly appreciated.

Respectfully,

Russell Mason Sr.
Tribal Chairman

cc: Edward Lone Fight/PM
Elgin Crows Breast/CPO
Felicia Felix/MR&I

Appendix G.

Appendix G.

Consultation letter from the U.S. Fish and Wildlife Service.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
1500 East Capitol Avenue
Bismarck, North Dakota 58501

APR 15 1997

Ms. Pamela Dryer, President
Blue Stem, Inc.
1501 N. 12th Street
P.O. Box 2432
Bismarck, North Dakota 58502

Re: U.S. Fish and Wildlife Service Comments on the Northwest Area Water Supply (NAWS) Project

Dear Ms. Dryer:

The U.S. Fish and Wildlife Service (Service) has reviewed your letter dated March 18, 1997, requesting consultation for threatened or endangered species, refuge coordination, and general project recommendations. In response to your request, the Service provides the following comments.

The Service is concerned with the development of projects that impact wetlands and stream habitats, or threatened and endangered species and their habitats. The Service recommends that construction through or adjacent to wetlands and streams be avoided where possible, and measures be taken to minimize disturbance to these areas. Locations of wetlands and streams in your project area have been identified on the National Wetlands Inventory (NWI). You are welcome to review the NWI maps in this office by calling and scheduling a convenient time for your review. If you have Internet connectivity, digital NWI maps can be obtained for free at the following URL address: http://www.nwi.fws.gov

Projects which involve the burying of a pipeline should not significantly affect wetland basins or stream channels, provided precautions are taken to restore natural basin contours. Precautions should also be taken during installation of underground facilities by compacting trenches sufficiently through the wetlands, thereby preventing drainage along the trench or through bottom seepage. Similar procedures should be applied in the restoration of stream channels.

Criteria have been developed for location and design of water intakes to minimize their effect on aquatic resources. These include locating the facilities in areas of the lake more than 20 feet deep, screening intake pipes with one-quarter inch mesh, and maintaining intake screen velocities at less than 0.5 feet per second. A generalized list of recommendations to minimize impacts to aquatic resources from pipeline construction is enclosed.

If construction is unavoidable in or near wetlands, the Service recommends deferring the timing of construction to late summer (after July 15) or fall to decrease disruption of waterfowl or other wildlife during the nesting season. Additionally, construction within this time frame allows you to avoid high water conditions. The Service also recommends construction be sited to avoid placement of fill in wetlands along the route. To minimize impacts to fish and wildlife habitats, it is recommended that you confine construction to the existing rights-of-way to the greatest extent possible.

The Service administers Waterfowl Production Areas in fee title and wetland easement tracts throughout the State of North Dakota. The Service requires that all practical actions be taken to avoid impacts to wetlands under its jurisdiction during project construction. Although permits for activities are generally not required on these lands if facilities are placed in existing rights-of-way, Special Use or right-of-way permits will be necessary for any construction activity on fee lands or easements where wetlands are impacted. You can determine the location of Service lands and easements at county courthouses, or by examining plat maps in our Realty office. Please contact the Wetland Habitat Office, Division of Realty, 1500 E. Capitol Ave., Bismarck, ND 58501, (701) 250-4415, to schedule an appointment to review the plat maps. For questions and assistance in preparing and filing permit applications, contact Mr. Al Lund, at the above referenced Realty office.

For specific questions on potential wetland impacts, you can contact the appropriate Wetland Management District (WMD) office for the county in question. The wetland managers are:

Audubon WMD, Mr. Dave Potter, 701-442-5474 (McLean, and Ward Counties).
J. Clark Salyer, Mr. Bob Howard, 701-768-2548 (Bottineau, and Renville Counties).

Lostwood WMD, Mr. Bob Barrett, 701-848-2466 (Mountrail).
Crosby WMD, Mr. Tim Kessler, 701-965-6488 (Burke, Divide, and Williams Counties).

A Section 404 permit from the Corps of Engineers may be required if you propose to drain or place fill material into the wetlands. If you have not already done so, I suggest you contact Mr. Jim Winters, Regulatory Office, Corps of Engineers, 1513 South 12th Street, Bismarck, North Dakota 58504 (701-255-0015), to determine their permit requirements.

Unavoidable losses of wetlands should be mitigated on an acre-for-acre basis. The loss of trees or shrubs should be replaced on a 2:1 basis. If grasslands are disturbed, I would recommend reseeding with native grasses and forbs. I suggest you contact the Natural Resources Conservation Service, concerning the seed mixture.

A list of federally endangered or threatened species which may be present in Burke, McLean, Mountrail, Williams, Divide, Ward, Bottineau, and Renville Counties is enclosed. Provision of this list fulfills requirements of the Fish and Wildlife Service under section 7 of the Endangered Species Act.

If a Federal agency authorizes, funds, or carries out a proposed action, the responsible Federal agency, or its delegated agent, is required to evaluate whether the proposed action "may affect" listed species. If it is determined that the proposed action "may affect" a listed species, then the responsible Federal agency shall request formal section 7 consultation with this office. If the evaluation shows a "no effect" situation on the listed species, further consultation is not necessary.

If you have any questions, or if further coordination on this project is necessary, please contact Bill Pearson at 701-250-4401.

Sincerely,

Allyn J. Sapa
Field Supervisor
North Dakota Field Office

Enclosures

cc: Project Leader, J. Clark Salyer NWR
(Attn: B. Howard)
Wetland Manager, Audubon NWR
(Attn: D. Potter)
Wetland Manager, Lostwood WMD
(Attn: B. Barrett)
Wetland Manager, Crosby WMD
(Attn: T. Kessler)
COE, Regulatory Office, Bismarck
(Attn: J. Winters)
Area Manager, Bureau of Reclamation, Bismarck
(Attn: R. Nelson)
Director, ND Game and Fish Department
(Attn: M. McKenna)

FEDERAL THREATENED, ENDANGERED, AND CANDIDATE SPECIES FOUND IN BURKE, MCLEAN, MOUNTRAIL, WILLIAMS, DIVIDE, WARD, BOTTINEAU, AND RENVILLE COUNTIES, NORTH DAKOTA

ENDANGERED SPECIES

Birds

Interior least tern (Sterna antillarum): Nests along midstream sandbars of the Missouri and Yellowstone Rivers.

Peregrine falcon (Falco peregrinus): Migrates spring and fall statewide but primarily along the major river courses. Historic nesting has been recorded in the Badlands.

Whooping crane (Grus Americana): Migrates through west and central counties during spring and fall. Prefers to roost on wetlands and stockdams with good visibility. Young adult summered in North Dakota in 1989, 1990, and 1993. Total population 140-150 birds.

Fish

Pallid sturgeon (Scaphirhynchus albus): Known only from the Missouri and Yellowstone Rivers. No reproduction has been documented in fifteen years.

Mammals

Black-footed ferret (Mustela nigripes): Exclusively associated with prairie dog towns. No records of occurrence in recent years, although there is potential for reintroduction in the future.

Gray wolf (Canis lupus): Occasional visitor in North Dakota. Most frequently observed in the Turtle Mountains area.

THREATENED SPECIES

Birds

Bald eagle (Haliaeetus leucocephalus): Migrates spring and fall statewide but primarily along the major river courses. It concentrates along the Missouri River during winter and is known to nest in the floodplain forest.

Piping plover (Charadrius melodus): Nests on midstream sandbars of the Missouri and Yellowstone Rivers and along shorelines of saline wetlands. More nest in North Dakota than any other state.

LISTED CANDIDATE

Fish

Sicklefin chub (Macrhybopsis meeki): Primarily inhabits main channels of turbid rivers. Known from the Missouri, Yellowstone, and Little Missouri Rivers.

Sturgeon chub (Macrhybopsis gelida): Primarily inhabits turbid rivers with rock or gravel bottom. Known from the Missouri, Yellowstone, and the Little Missouri Rivers.

General Recommendations to Minimize Impacts to Aquatic Resources from Pipeline Construction

1. Aquatic resources should be thoroughly inventoried upstream and downstream from the proposed crossing area, mainly for the presence of rare and endangered species.

2. The U. S. Fish and Wildlife Service and the North Dakota Game and Fish Department would appreciate participating in selection of the final right-of-way stream crossing sites.

3. The right-of-way should be prepared on either side of the stream prior to the construction of the crossing to minimize the time required for the stream crossing. Care should be taken to preserve as many existing trees on the stream bank as possible.

4. Herbicides should not be used within 75 yards of the high water mark on any of the stream crossings.

5. Disturbance of the streambanks and bottoms should be delayed as long as possible so that the duration of exposure is minimized.

6. Dredging should not take place during the months of March, April, May and June to reduce impacts upon spawning fish.

7. If any spawning areas are destroyed, artificial spawning beds should be constructed in a suitable reach of the river, as designated by fishery biologists.

8. Intermittent streams should be crossed only during low flow periods and preferably when the streambeds are dry.

9. Instream flow should be maintained during the construction of the stream crossings.

10. All stream crossings should be perpendicular to the flow and at a location where shear forces are minimal.

11. The respective permits for river crossings should be approved before any construction is begun for that river.

12. Dredging and trenching spoil should be placed in controlled areas away from the waterway flood plain.

13. If the pipeline construction is curtailed for any reason and for any appreciable length of time, temporary erosion control measures should be employed at the crossings.

14. The pipeline should be weighted in the flood plains, as well as the streambeds, for protection against flotation during high water periods.

15. The pipeline should be extra thick-walled in flood plains, as well as in the streambeds, for protection against breakage during high water periods.

16. Automatic shutoff valves should be installed at all major river crossings and where the pipeline crosses upstream from critical or unique areas.

17. Hydrostatic test water should be obtained from appropriate and approved sources and, before any test discharges are made into the waterway, the appropriate discharge permit should be approved.

18. Trench excavation across waterways should be backfilled to original streambed elevation and grade.

19. Stabilization, restoration and revegetation of streambeds should be performed as soon as the stream crossing is completed.

20. The streambands should be replanted with shrubbery where necessary to preserve the shading characteristics of the watercourse and the aesthetic nature of the streambanks.

21. Spoil, debris, piling, construction materials, and any other obstructions resulting from construction of the pipeline should be removed from the crossing to prevent interference with normal water flow and interference with any normal use.

22. Streambanks that have been stabilized should be checked periodically to assure stabilization and, where needed, redone.

23. Temporary downstream siltation control measures should be used during stream crossing construction.

Appendix H.

Appendix H.

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